NORTHUMBERLAND SEA FISHERIES COMMITTEE.

REPORT on the Scientific Investigations

For the Year 1905.

EDITED BY ALEXANDER MEEK, M.Sc., F.Z.S.,

THE MARINE LABORATORY, CULLERCOATS, AND ARMSTRONG COLLEGE (IN THE UNIVERSITY OF DURHAM), NEWCASTLE-UPON-TYNE.

Printed by Order of the Committee.

31ST DECEMBER, 1905.

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CONTENTS.

SUMMARY AND GENERAL REPORT.

I beg to submit the report on the scientific investigations for the year ending 31st December, 1905.

The delay in publication has been brought about by an attempt to forestall a desired if not inevitable co-ordination of fishery research in England by getting the Board of Agriculture and Fisheries to publish our annual report. The attempt raised a number of difficulties, not the least of which was that connected with editing the papers. At length it was determined in the meantime to publish the report locally as heretofore. It is to be hoped however that the important question, the fringe of which has been touched by our negotiations will be solved through the Board becoming more closely associated with the work of fishery research in England.

The report contains a more exhaustive account of the White Fisheries of Northumberland than has hitherto been possible, based on the results of 14 years continuous trawling experiments, Government statistics, and a consideration of the history of the local fisheries.

The trawling experiments have been made at stations close to the shore during the summer, and the majority of the stations have been visited twice each year. Even during the short season, the experiments indicate that the stations are liable to gain and loss from the areas immediately outside, but within the district, and that the inward movement may also and usually does include deep-sea extra-territorial fish, especially plaice.

The stations may be divided into two northern and four southern, and the contrast between the two divisions, with regard to the relative numbers of flat fish, is as striking as that previously shown in the case of the crab (*v.* last year's report). This is borne out and extended to other forms by an appeal to the statistics of the inshore fisheries.

The results have been reduced to a common standard—the catch per one hour's trawling. They demonstrate that the population of flat fish improved steadily from 1892 to 1903, since when there has been a decline. The above examination with reference to season shows that the increase has been to a large extent brought about by the late summer immigration.

An interesting change with regard to the food of the fish caught at the trawling experiments has taken place, sandeels having replaced common molluscan and crustacean forms, which latter also have evidently diminished in numbers.

At the trawling experiments of 1905, 372 flat fish were marked and liberated, principally dab, flounder and turbot. The total number which have been labelled since 1903 is 1,321. It is now evident that plaice remain within the district until at least about 11½ or 12 inches in length, when they are about 5 years old, and that the migration from the district, with approaching maturity, may be to a great distance. The dab and flounder show a tendency to migrate to the south, but this only refers to a few examples, the large majority evidently being stationary.

The trawling and migration experiments have furnished information with regard to the growth of the flat fish.

A brief account is given of the modern decline in the inshore white fisheries, and of the growth of North Shields.

It is concluded that the improvement in flat fish shown by the experiments, is due to the protection afforded to the resident young population by the prohibition of trawling within the district.

A further consideration of the crab and lobster fisheries of Northumberland demonstrates that the protection of such fisheries by reasonable legislation may be depended upon as a means of improvement. The experiments on the migration of the crab confirm the previous results that the hardening females migrate into Scottish waters.

Miss M. V. Lebour, B.Sc., gives a paper on the Trematodes which have been met with in the course of an examination of Mollusca, and especially of the common mussel, in connection with a research on the mussel beds of Northumberland.

A start is about to be made with the building of the New Marine Laboratory at Cullercoats, and it is expected that it will be ready for occupation early next year. The arrangements which have been made are as follows:—W. H. Hudleston, Esq., the owner of the site on which the old baths house in Cullercoats haven stands, and on part of which the old laboratory was situated, has agreed to build a laboratory thereon, and a quay wall to protect the building at a cost of £3,000. The Council of Armstrong College have accepted the tenancy and will pay a rental of 3 per cent. on the outlay. The building fund of £2,000 has been transferred to a capital fund invested by the College Council, subject, however, to a deduction for compensation to the present tenant of the bath house.

The Laboratory Committee have therefore reason to be satisfied with the results of their efforts. The Laboratory will occupy an admirable site and has the advantage of being near Newcastle, to and from which electric trains run every 15 minutes. The Committee have especially to thank an anonymous donor through whose kindness the successful negotiations with Mr. Hudleston were made possible.

Alexander Meek.

THE WHITE FISHERIES OF NORTHUMBERLAND.

By A. MEEK.

CONTENTS.

I.—TRAWLING EXPERIMENTS.

A.—RESULTS FOR 1905.

The year 1905 completes the fourteenth year of the Northumberland trawling experiments, and it is now proposed to discuss the results as a whole, and at the same time to bring under review the white fisheries of the district in general.

It is necessary in the first place to present briefly the results obtained in 1905. The trawling stations, the particulars of which will be given in the next section, were experimented in this year on the same lines as in previous years. The catches of marketable fish made on each occasion are recorded in Table I., and the length of time devoted to each station, the general conditions of weather, temperature, &c., are given in Table II. In Table III. are set forth the measurements of the fish caught during the first haul at the stations visited during the year.

TABLE I.

Place.	Date.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fish.	Cod.	Haddock.	Whiting.	Gurnard.	Skate	Total.
Cambois Bay	June 30th...	4	...	7	53	44	6	114	...	...	...	2	...	116
Alnmouth Bay	July 12th ...	14	...	22	75	55	4	170	...	1	...	2	...	173
Druridge Bay	,, 19th ...	19	2	10	101	96	...	228	1	...	1	48 *a*	...	278
Blyth Bay	,, 26th ...	8	...	34	91	41	15	189	1	...	...	22	...	212
Druridge Bay	Aug. 2nd ...	37	...	32	127	116	2	314	...	...	...	53 *b*	...	367
Skate Roads	,, 7th ...	56	...	3	151	64	...	274	...	...	...	42	3	319
Alnmouth Bay	,, 16th ...	15	...	34	81	28	12	170	2 *c*	...	...	33 *b*	...	205
Cambois Bay	,, 23rd ...	2	...	25	12	104	...	143	...	...	...	...	...	143
Blyth Bay	,, 23rd ...	1	...	6	21	38	...	66	...	...	...	3	...	69
Cambois Bay	Sept. 1st ...	4	...	30	66	36	...	136	1	2	...	45	...	184
Druridge Bay	,, 6th ...	7	...	29	43	49	2	130	...	...	...	145	2	277

a. A few caught by line. *b*. Many caught by line. *c*. One caught by line.

Place.	Date.	Experiment.			Mid-day Temperature.		Wind.	Sea.	Weather.	Condition of Ground.
		Began.	Ended.	Time.	Air.	Water.				
		a.m.	p.m.							
Cambois Bay ...	June 30th ...	10·45	6·30 *a*	7 hour 15 mins.	62	56	N.E.	Slight	Dull	Clean
Almmouth Bay ...	July 12th ...	11·15	6·40	7 ,, 25 ,,	70	55	W.. squally	Smooth	Dull, rainy	Clean
Druridge Bay ...	,, 19th ...	10·10	7·15	9 ,, 5 ,,	64	58	S.S.E.	Moderate	Clear. fine	Weed near L.W. mark only
Blyth Bay ...	,, 26th ...	9·15	8·30 *b*	10 ,, 30 ,,	66	57	W. by N.	Smooth	Fair	Weed near L.W. mark only
Druridge Bay ...	Aug. 2nd...	10·5	7·10	9 ,, 5 ,,	64	56	W.N.W.	Do.	Fine. cloudy	Clean
Skate Roads ...	,, 7th ...	6·10	4·0	9 ,, 50 ,,	65	56	S.E.	Do.	Hazy	Much weed near L.W. mark
Almmouth Bay ...	,, 16th ...	10·55	6·35 *c*	7 ,, 10 ,,	64	56	N.E., light	Do.	Fine	Clean
Cambois Bay ...	,, 23rd ...	9·28	3·10	5 ,, 42 ,,	60	56	N.N.E., mod. breeze	Moderate	Cloudy	Clean
		p.m.								
Blyth Bay ...	,, 23rd ...	3·35	7·35	4 ,,	...	...	N.N.E.	Do.	Fine, clear	Clean
Cambois Bay ...	Sept. 1st ...	3·10	7·10	4 ,,	...	...	...	...	...	...
		a.m.								
Druridge Bay ...	,, 6th ...	10·10	6·50 *d*	8 ,, 10 ,,	62	56	S.E.	Smooth	Unsettled, rainy	Much weed in bay and on shore

a. Net seriously torn at 4·35 p.m., and replaced by a new one, lost ½ hour.
b. Lost ¾ hour at mid-day. *c*. Net fouled at 5·20. lost ½ hour. *d*. Lost ¼ hour cleaning net.

TABLE III.

SKATE ROADS, June 29th. Began 2·45 p.m., ended 3·35 p.m. Time, 50 minutes.

CENTIMETRES.

	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	54	56	62	Total.
Plaice	...	...	...	...	...	...	...	...	2	4	3	3	5	3	...	1	5	..	1	...	...	...	1	1	...	1	...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	32
Dab	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
Flounder	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	3	1	1	...	...	1	...	1	1	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	9
																																															45

CAMBOIS BAY, June 30th. Began 10·45 a.m, ended 11·45 a.m. Time, 1 hour.

Plaice	...	...	...	...	...	1	1	1	...	4	3	...	2	...	...	...	3	1	...	1	1	3	...	1	2	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	27
Dab	...	...	...	...	...	...	...	...	1	3	5	4	1	1	1	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	18
Sole	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Turbot	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Flounder	...	...	...	...	...	...	..	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Gurnard	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Angler	...	...	...	...	...	...	...	...	...	...	...	...	1	1	2	...	...	3	2	2	1	1	...	...	1	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	18
																																														71

ALNMOUTH BAY, July 12th. Began 11·15 a.m, ended 12·30 p.m. Time, 1 hour 15 minutes.

Plaice	...	...	...	...	2	...	...	1	...	3	1	5	1	1	2	...	...	1	1	1	2	2	2	2	...	...	...	3	3	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	35
Dab	...	...	...	...	...	1	2	1	4	4	4	4	5	2	5	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	33
Sole	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	2	1	...	...	...	..	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Turbot	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Flounder	...	...	...	...	...	...	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Gurnard	...	...	3	1	1	2	2	6	6	3	1	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	27
Angler	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	2	1	1	1	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1	11
																																															112

DRURIDGE BAY, July 19th. Began 10·10 a.m., ended 11·10 a.m. Time, 1 hour.

CENTIMETRES.

	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	35	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	54	56	62	Total.
Plaice				1				2	3	1	2	1	1			1	2	1		2		1		2		2			1	1									1								25
Dab							1	6	2	2	2	2	3	2	2	3	1	1			1																										28
Sole																				1		1			1	1																				4
Angler													2	1		1	1	1		1				1																						8
Gurnard																	1	2	1	1				1	1	1																				8
																																													73

BLYTH BAY, July 26th. Began at 9 15 a.m, ended 10·3 a.m. Time, 48 minutes.

Plaice						2		1	1	2	1	3	4	2	2	4	4	3	1	3	2	1				1	1																		38
Dab								1	4	7	7	5	1		1							1																									27
Sole																										1	1																			2
Turbot																														1																1
Flounder											1		1			2				1																										5
Codling															1			1																												2
Gurnard							1	1	1		1										1			1		1		1																	8
Angler														1			1		1																											3
																																													86

DRURIDGE BAY, August 2nd. Began 10·5 a.m., ended 11 5 a.m. Time, 1 hour.

														4		1			1		3			2		1		1		1															14
Plaice																																													14
Dab							2	5	10	3	5	3	6	1	5	2	2	1			1																									46
Sole																										1			1					1											3
Turbot																									1					1															2
Gurnard																			1				1																						2
Angler								1			2	1			1	2	1	2	3	1						1		1																	16
																																													83

TABLE III.—Continued.

SKATE ROADS, August 7th. Began 6·10 a.m.. ended 7·10 a.m. Time, 1 hour.

CENTIMETRES.

	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	54	56	62	Total.
Plaice											1		5	3	1	3	5	6	4	2	1	2	3	4	1	1	1				1			1														45
Dab													1	1							1	1																										4
Turbot														1										1	1	3																						6
Flounder															1						1																										2
Gurnard												1					1		1																												3
Angler																																											1			1
																																													61

ALNMOUTH BAY, August 16th. Began 10 55 a.m , ended 11 55 a.m. Time, 1 hour.

Plaice							1	4	1	1	6	6	2	2	1	1	4	2		3						1																				35
Dab				1			5	9	14	21	8	8	3		1	1		3																													74
Sole																							1		1	1																				3
Turbot																		1							1																				2
Angler												3		1	1		4	2	2		1			1	1																				17
Gurnard				1				1	1											1																										4
																																													135

CAMBOIS BAY, August 23rd. Began 9 28 a.m., ended 10·38 a.m. Time, 1 hour 10 minutes.

Plaice				1	2	1	1		3		4									1																										13
Dab					4	7	5	19	24	13	13	9	9	2		1					1																										107
Turbot																						1																									1
Sole																					2		1			1			3																	7
Gurnard			2	1						1																																					4
Angler											1	1		1	2	4	3			1	1	1																									15
																																														147

BLYTH BAY, August 23rd. Began 3·35 p.m., ended 4·5 p.m. Time, 30 minutes.

CENTIMETRES

	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	54	56	62	Total.
Plaice	...	...	...	...	...	1	3	1	1	1	1	6	6	...	3	3	1	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	29
Dab	...	...	...	...	...	...	1	...	3	9	21	10	12	8	2	5	...	1	...	...	1	1	1	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	75
Sole	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
Gurnard	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	..	2	...	...	1	...	1	1	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	6
Angler	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	2	3	2	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	13
																																														126

CAMBOIS BAY, September 1st. Began 2·10 p.m., ended 3 10 p.m. Time, 1 hour.

Plaice	...	...	...	...	...	2	...	1	2	2	...	3	2	2	3	...	1	...	...	...	1	1	...	...	1	1	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	24
Dab	...	...	...	...	...	...	...	...	...	...	4	2	5	2	4	2	2	1	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	24
Turbot	...	..	.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Sole	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.	...	...	1	...	1	...	...	4	...	...	...	...	...	...	...	...	...	...	...	1	...	..	...	..	...	...	7
Flounder	...	...	...	...	...	.	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Codling	...	..	.	...	...	...	...	...	...	...	...	...	...	.	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Gurnard	...	...	...	...	...	...	...	...	...	...	1	1	2	...	...	...	...	...	1	.	4	2	...	...	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	14
																																														72

DRURIDGE BAY, September 6th. Began at 10·10 a.m., ended 11·10 a.m. Time, 1 hour.

Plaice	...	..	...	...	1	...	2	...	...	...	...	1	...	2	1	...	1	...	1	2	3	1	...	...	...	...	...	1	1	..	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	18
Dab	...	...	..	...	...	...	...	1	...	5	7	9	4	1	4	...	2	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	35
Turbot	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	..	2
Sole	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	...	...	1	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6
Gurnard	...	...	...	...	...	...	...	3	5	2	4	2	5	5	2	9	1	5	2	3	2	3	1	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	57
Angler	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	4
																																														122

CAMBOIS BAY, September 13th. Began 8·20 a.m., ended 9·20 a.m. Time, 1 hour.

Plaice	...	...	...	...	1	...	...	...	...	...	...	1	1	2	2	3	1	1	...	1	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	14
Dab	...	1	...	2	3	4	5	14	6	16	11	5	6	5	3	1	3	1	1	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	89
Sole	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1	...	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6
Gurnard	...	...	...	...	...	5	3	1	1	3	6	1	...	1	...	1	...	...	...	...	3	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	26
Angler	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
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B.—RESULTS FOR 14 YEARS.

Introduction.—The trawling experiments were commenced by Ald. Dent, Chairman of the Northumberland Committee, in 1892, with the intention of reporting to the Committee whether the inshore waters were likely to benefit from the byelaw, passed in the previous year, prohibiting trawling within the district. When they were placed in my hands in 1896 I thought it advisable not to interfere with the general nature of the experiments, so that they have been conducted for the whole period in practically the same manner.

Whatever value they may possess, it is only right and to me a pleasure to acknowledge with grateful thanks the help received in making the experiments by constant association with Mr. Dent. The earlier experiments were made with the "Livingstone" and the later with the "Stanley"—steamers, both belonging to Mr. Dent, who placed them at our service, and equipped them for the purpose.

The trawl nets used have all been of similar construction, and the length of beam has been throughout the same, viz.: 22 feet. The experiments have been made during the summer months each year,—more exactly from the latter part of June to about the middle of September—along lines parallel to and close to the shore in defined stations within the Committee's district.

The stations were shown on a chart in the report for 1903, and from north to south, are:—

Distance between Stations.	Name of Bay = Station.	Depth.	Length of Station.
	Goswick Bay ...	2-5 fathoms...	3 miles.
5 miles			
	Skate Roads ...	$2\frac{1}{2}$-4 ,, ...	$2\frac{5}{6}$,,
15 ,,			
	Alnmouth Bay ...	2-3 ,, ...	3 ,,
4 ,,			
	Druridge Bay ...	2-3 ,, ...	$3\frac{1}{6}$,,
5 ,,			
	Cambois Bay ...	2-3 ,, ...	$1\frac{1}{6}$,,
2 ,,			
	Blyth bay	2-5 ,, ...	$1\frac{5}{6}$,,

The following was the general procedure on each occasion. The steamer started from Blyth on the arrival of the morning train, and trawling was commenced immediately the station chosen was reached. The catch obtained at the first haul was measured, every fish useful or otherwise being thus recorded. Thereafter the

rawling was continued until the time came when it was necessary o return to Blyth to catch the train leaving at 9·20 p.m. During he day a number of the fish were examined with regard to their food nd maturity, and in recent years many of the fish caught were etained after each haul to be marked and returned to the water. At the end of the day's trawling all the marketable fish were counted. The small examples were returned after every haul, and as I have pointed out before in a living condition.

On the few occasions that the first haul showed that the ground was in an abnormal condition, usually from the presence of great quantities of weed, another station was experimented in instead. The two most northerly stations were trawled in from early morning to late afternoon.

Marketable Fish. 1.—Seasonal Variation.

It is proposed to deal first with the marketable flat fish, that is to say, with the fish referred to above which were comted at the end of an experiment lasting usually from seven to ten hours.

In previous reports, bearing in mind the regularity with which the experiments were made in relation to fixed trains, the results were presented in the form of the total catch for the day in each case. For the purpose, however, of instituting a strict comparison between the various stations, and with the records of the first haul, which will be dealt with next, the results are now expressed in common terms, viz: the catch per hour's trawling.

A summary of the catches of flat fish for the period of 14 years is given in Table IV., which also shows the mean catch per hour for that period.

The details of all the experiments are given in Table V., viz.: the catch per hour for each experiment, the mean catch per hour for each station, and the mean catch per hour for the area each year.

As each station was visited each season once, twice, or at most three times, and was trawled in for a period of many hours, it is not possible to determine their character by reference to a large number of experiments for any one season, or to a part of a season. The degree of variability may be estimated, however, in one or two cases where the experiments were repeated within a short period. For example in 1902, Cambois Bay was experimented in on June 28th (8 hours), on July 2nd (9¼ hours), and on July 23rd (9¼ hours). The mean catch per hour on these dates was: plaice, 15·13, 9·95, and 14·05; dab, 11·88, 16·43, and 10·81. Again in 1892, the same bay was visited on August 11th (10 hours), on September 13th

(10 hours), and on September 15th (10 hours). The mean catch on these occasions was: plaice, 8·00, 12·00, and 8·10; dab, 4·40, 8.00 and 4·70.

The period from June 17th to September 22nd includes all the dates of the experiments, and consists of seven periods of 14 days, viz.:—

1.—June 17th to June 30th.
2.—July 1st to July 14th.
3.—July 15th to July 28th.
4.—July 29th to August 11th.
5.—August 12th to August 25th.
6.—August 26th to September 8th.
7.—September 9th to September 22nd.

TABLE IV.

Total catch of Flat Fish each year, and the time in which it was made.

Year	Days.	Time.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Flat Fi
		H. M.							
1892	7	69 15	7	1	32	589	334	...	963
1893	8	70 30	43	...	163	557	360	...	1123
1894	10	88 30	123	...	196	1028	347	64	1758
1895	11	95 13	38	...	83	1012	501	2	1636
1896	12	97 15	124	2	185	1343	676	76	2406
1897	8	74 30	139	10	125	1012	514	48	1848
1898	9	72 45	79	11	36	978	689	44	1837
1899	10	78	49	4	62	1118	716	50	1999
1900	8	57	29	4	112	884	768	48	1845
1901	10	78 30	70	11	68	1312	740	47	2248
1902	9	74 55	37	3	189	1487	1089	48	2853
1903	10	83 30	133	10	537	1806	1155	77	3718
1904	9	74 25	66	2	271	1503	720	110	2672
1905	11	82 12	167	2	232	821	671	41	1934
14 years' Total		1096 30	1104	60	2291	15450	9280	655	28840
Catch per hour		... ...	1·00	·06	2·09	14·09	8·46	·60	26·30

TABLE V.

Catch of Flat Fish per hour's trawling.

Station	1905.	Turbot.	Brill.	Sole.	Plaice	Dab.	Flounder.	Flat Fish.
bois Bay ..	June 30	·55	—	·97	7·31	6·07	·83	15·73
nouth Bay	July 12	1·89	—	2·97	10·11	7·42	·54	22·93
idge Bay...	,, 19	2·11	·22	1·11	11·22	10·67	—	25·33
h Bay ...	,, 26	·76	—	3·24	8·67	3·90	1·43	18·00
idge Bay ..	Aug. 2	4·11	—	3·56	14·11	12·89	·22	34·89
e Roads ...	,, 7	5·70	—	·30	15·36	6·51	—	27·87
nouth Bay	,, 16	2·10	—	4·74	11·30	3·91	1·67	23·72
bois Bay ...	,, 23	·35	—	4·39	2·10	18·25	—	25·09
h Bay ...	,, 23	·25	—	1·50	5·25	9·50	—	16·50
bois Bay ...	Sept. 1	1·00	—	7·50	16·50	9·00	—	34·00
idge Bay...	,, 6	·86	—	3·55	5·27	6·00	·24	15·92
he Stations	1905	2·03	0·02	2·82	9·99	8·16	·50	23·52
bois Bay ...	,, ...	·59	—	3·66	7·73	10·86	·35	23·19
nouth Bay	,, ...	2·00	—	3·86	10·76	5·73	1·10	23·45
idge Bay .	,, ...	2·40	·07	2·70	10·30	9·91	·15	25·53
1 Bay ..	,, ...	·62	—	2·76	7·72	5·45	1·03	17·58
	1904.							
bois Bay ...	June 24	—		6·67	7·73	12·80	·80	28·00
idge Bay...	July 6	1·07	·11	3·96	21·32	9·96	—	36·42
nouth Bay	,, 13	·13	—	3·06	40·85	3·96	3·83	51·83
idge Bay...	Aug. 10	1·41	·12	2·12	24·24	20·00	·60	48·48
h Bay ...	,, 17		—	·98	23·61	9·84	1·97	36·40
bois Bay .	,, 24	·64	—	7·04	7·04	14·40	—	29·12
nouth Bay	Sept. 7	1·68	—	1·42	15·49	6·32	4·51	29·42
he Stations	1904 ...	·90	·03	3·63	20·17	9·66	1·48	35·87
bois Bay .	,, ...	·29	—	6·83	7·42	13·53	·44	28·51
idge Bay...	,, ...	1·23	·11	3·08	22·71	14·75	·28	42·17
nouth Bay	,, ...	·95	—	2·37	29·83	5·42	4·11	42·98
	1903.							
wick Bay .	June 26	·80	1·07	1·07	5·87	2·13	2·40	13·34
nouth Bay	July 3	2·67	—	6·93	12·93	13·60	·67	36·80
bois Bay ...	,, 9	·10	—	15·20	8·10	7·60	—	31·00
idge Bay...	,, 15	·78	·11	8·22	11·22	11·89	1·00	33·22
h Bay ...	,, 23	2·13	·13	3·34	35·20	20·00	2·00	62·80
e Roads ...	Aug. 4	2·22	·78	·56	50·55	7·56	2·78	64·45
idge Bay..	,, 12	2·11	—	4·89	23·56	23·33	·22	54·11
nouth Bay	,, 19	2·22	·15	4·45	10·07	12·74	1·33	30·96
bois Bay ...	,, 26	1·16	—	10·53	12·63	10·63	·11	35·06
h Bay ...	Sept. 2	·45	—	2·96	30·67	18·07	1·48	53·63
idge Bay...	,, 9	2·47	—	4·12	23·65	15·65	·11	46·00
he Stations								
ept Goswick	1903 ...	1·59	·12	6·43	21·63	13·83	·92	44·52
nouth Bay	,, ...	2·46	·07	5·75	11·58	13·19	·98	34·03
bois Bay	,, ...	·61	—	12·92	10·31	9·08	·05	32·97
idge Bay...	,, ...	1·77	·04	5·77	19·40	16·98	·45	44·41
h Bay ...	,, ...	1·33	·07	3·16	33·05	19·09	1·75	58·45

TABLE V.—Continued.

Catch of Flat Fish per hour's trawling.

Station.	1902.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Flat
Cambois Bay ...	June 28	·12	·12	3·00	15·13	11·88	·50	30·
,, ...	July 2	·11	—	1·08	9·95	16·43	·65	28·
Alnmouth Bay	,, 9	·13	—	1·47	16·80	16·53	·27	35·
Druridge Bay...	,, 16	·81	—	3·46	22·62	13·15	·11	40·
Cambois Bay ...	,, 23	—	—	2·16	14·05	10·81	·87	27·
Alnmouth Bay	,, 30	·33	—	2·00	9·78	11·11	1·45	24·
Druridge Bay...	Aug. 20	1·18	·12	1·53	38·12	25·30	·81	67·
Alnmouth Bay	,, 27	1·81	·13	5·16	15·48	12·90	·65	36·
Blyth Bay ...	Sept. 11	—	—	3·29	41·43	12·71	·29	57·
All the Stations	1902 ...	·49	·04	2·52	19·83	14·52	·64	38·
Cambois Bay ...	,, ..	·08	·04	2·04	12·94	13·10	·68	28·
Alnmouth Bay	,, ..	·74	·04	2·85	13·77	13·36	·82	31·
Druridge Bay...	,, ..	·99	·06	2·50	30·29	19·17	·47	53·
	1901.							
Skate Roads ..	June 20	2·48	·14	—	16·69	2·62	·83	22·
,, ..	,, 28	3·09	1·27	—	16·00	1·09	4·73	26·
Cambois Bay ..	July 3	·36	—	·73	5·82	5·64	·18	12·
Blyth Bay ...	,, 3	—	·50	1·00	5·50	4·50	—	11·
Druridge Bay .	,, 10	·22	—	2·45	11·67	5·66	—	20·
Alnmouth Bay	,, 24	—	—	·27	19·87	16·80	—	36·
Druridge Bay...	,, 31	·22	—	1·78	10·44	18·78	·11	31·
Skate Roads ...	Aug. 6	2·10	·10	—	10·60	·20	—	13·
Alnmouth Bay	,, 14	·26	—	1·68	34·84	14·32	·78	51·
Cambois Bay ...	,, 28	·31	—	·31	19·23	11·85	·92	32·
Druridge Bay...	Sept. 12	·47	·12	·82	24·82	16·35	·12	42·
All the Stations	1901 ...	·89	·14	·86	16·71	9·43	·60	28·
Skate Roads ..	,, ...	2·36	·38	—	13·26	1·14	1·35	18·
Cambois Bay ..	,, ...	·33	—	·50	13·08	9·00	·59	23·
Druridge Bay...	,, ...	·30	·04	1·70	15·47	13·55	·08	31·
Alnmouth Bay	,, ..	·13	—	·98	27·48	15·54	·39	44·
	1900.							
Druridge Bay...	June 20	1·52	·14	·97	13·93	7·17	—	23·
Alnmouth Bay	,, 29	·13	·13	·80	15·73	10·80	3·47	31·
Blyth Bay ...	July 4	·15	—	1·53	29·70	8·46	·16	40·
Cambois Bay ...	,, 11	·42	·21	1·69	4·42	12·42	·21	19·
Alnmouth Bay	,, 25	·52	—	2·97	12·39	23·22	·64	39·
Skate Roads ...	Aug. 6	—	—	2·00	16·00	6·00	—	24·
Druridge Bay .	,, 6	·32	—	3·41	12·81	14·60	·32	31·
Alnmouth Bay	,, 14	·27	—	2·53	18·67	17·47	1·60	40·
Druridge Bay...	Sept. 12	·71	·12	1·88	14·12	13·41	·12	30·
All the Stations	1900 ...	·51	·07	1·97	15·51	13·47	·84	32·
Druridge Bay...	,, ..	·86	·09	2·00	13·64	11·64	·13	28·
Alnmouth Bay	,, ..	·31	·04	2·11	15·56	17·23	1·89	37·

TABLE V.—Continued.

Catch of Flat Fish per hour's trawling.

Station.	1899.	Turbot	Brill.	Sole.	Plaice.	Dab.	Flounder.	Flat Fish.
te Roads ...	June 21	—	—	—	25·00	1·67	3·33	30·00
wick Bay ...	,, 23	—	·67	—	7·33	·67	1·00	9·67
te Roads ...	,, 23	·23	—	—	6·82	—	·71	7·76
mouth Bay	July 5	—	·12	·13	9·50	9·50	1·50	20·75
ridge Bay...	,, 19	·11	—	·11	2·59	7·03	·11	9·95
,, ...	,, 26	·22	·11	·32	10·92	6·49	—	18·06
te Roads ...	Aug. 7	2·25	—	—	21·13	4·87	1·38	29·63
bois Bay ...	,, 16	·70	·10	1·90	12·60	11·20	—	26·50
ridge Bay...	,, 23	1·09	·11	2·16	19·03	16·97	·33	39·69
bois Bay ...	,, 30	·60	—	2·00	16·20	8·80	·20	27·80
th Bay ..	,, 30	—	—	—	20·00	19·00	—	39·00
mouth Bay	Sept. 6	·88	—	1·00	30·12	17·38	1·12	50·50
the Stations								
ept Goswick	1899 ..	·63	·05	·79	14·33	9·18	·64	25·62
te Roads	,, ..	1·25	—	—	17·90	2·89	1·57	23·61
mouth Bay	,, ...	·44	·06	·56	19·81	13·44	1·31	35·62
ridge Bay..	,, ..	·47	·07	·86	10·85	10·16	·15	22·56
bois Bay ...	,, ...	·67	·07	1·93	13·80	10·40	·07	26·94
	1898.							
te Roads	June 23	2·56	·56	·11	10·55	4·33	·67	18·78
ridge Bay...	,, 30	·76	·11	·32	11·35	9·84	·11	22·49
mouth Bay	July 6	1·38	—	·38	14·63	7·38	2·23	26·00
th Bay ..	,, 13	·25	—	2·75	25·75	16·75	·25	45·75
ridge Bay .	,, 20	1·19	·22	·65	7·57	16·22	·32	26·17
mouth Bay	,, 27	1·12	·25	—	24·38	14·13	·62	40·50
te Roads .	Aug. 1	·78	·11	·22	17·11	1·78	·78	20·78
bois Bay ..	,, 10	·29	—	1·00	8·00	11·71	·14	21·14
wick Bay ..	,, 22	2·71	1·00	·14	67·71	4·15	1·00	76·71
ridge Bay	,, 31	·87	-	·32	8·97	7·78	·22	18·16
wick Bay ...	Sept. 5	2·00	1·00	·71	65·44	6·71	3·00	78·86
the Stations								
ept Goswick	1898 ...	1·09	·15	·49	13·44	9·47	·61	25·25
te Roads ...	,, ...	1·67	·33	·17	13·83	3·06	·72	19·78
ridge Bay..	,, ...	·94	·11	·43	9·30	11·28	·21	22·27
mouth Bay	,, ..	1·25	·12	·19	19·50	10·75	1·44	33·25
	1897.							
te Roads ...	June 23	4·40	·70	·50	11·10	2·00	2·10	20·80
mouth Bay	July 7	·75	—	·25	7·25	7·75	·13	16·13
bois Bay ..	,, 14	·50	—	3·20	10·40	7·30	—	21·40
ridge Bay...	,, 28	2·38	·11	4·00	13·95	3·67	·32	24·43
te Roads ...	Aug. 11	3·30	·20	·60	13·80	3·00	1·00	21·90
mouth Bay	.. 19	1·00	—	1·25	31·63	5·37	·63	39·88
th Bay ...	.. 25	·57	—	·86	15·71	10·00	1·43	28·57
bois Bay ...	.. 25	—	—	2·31	9·54	17·38	—	29·23
ridge Bay...	Sept. 1	2·05	—	1·62	11·03	11·24	·33	26·27
the Stations	1897 ...	1·87	·13	1·68	13·58	6·90	·64	24·80
te Roads ...	,, ..	3·85	·45	·55	12·45	2·50	1·55	21·35
mouth Bay	,, ..	·87	—	·75	19·44	6·56	·38	28·00
mbois Bay ...	,, ...	·30	—	2·85	10·06	11·27	—	24·48
ridge Bay...	,, ..	2·22	·05	2·81	12·49	7·46	·32	25·35

TABLE V.—Continued.

Catch of Flat Fish per hour's trawling.

Station.	1896.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Flat I
Blyth Bay ...	June 18	·70	—	·50	8·50	4·40	—	14·1
Skate Roads ...	,, 24	·40	—	·20	14·30	·90	3·40	19·2
Cambois Bay ...	July 2	—	—	1·00	9·67	4·67	—	15·3
Druridge Bay...	,, 9	·97	—	3·79	17·30	7·35	—	29·4
Cambois Bay ...	,, 15	·50	—	2·50	7·50	—	—	10·2
Alnmouth Bay	,, 23	1·63	—	3·75	25·25	14·62	·37	45·0
Druridge Bay...	,, 29	·86	—	·86	16·97	7·36	·11	26·1
Skate Roads ...	Aug. 3	5·88	·12	·23	18·23	1·18	3·77	29·4
Cambois Bay ...	,, 12	·80	—	2·40	7·60	8·10	—	18·9
Alnmouth Bay	,, 19	1·13	·12	1·13	19·25	5·50	·37	27·4
Blyth Bay ...	,, 26	·20	—	3·60	6·30	7·80	·20	18·1
Druridge Bay...	Sept. 8	1·41	—	2·80	11·24	13·30	·11	28·8
All the Stations	1896 ...	1·24	·02	1·85	13·47	6·78	·76	24·1
Blyth Bay ...	,, ...	·45	—	2·05	7·40	6·10	·10	16·1
Skate Roads ...	,, ...	2·92	·05	·22	16·11	1·03	3·57	23·9
Cambois Bay ...	,, ...	·60	—	2·13	8·00	6·33	—	17·0
Druridge Bay...	,, ...	1·08	—	2·49	15·17	9·33	·07	28·1
Alnmouth Bay	,, ...	1·37	·06	2·44	22·25	10·06	·38	36·4
	1895.							
Druridge Bay...	June 20	·56	—	·67	13·33	1·67	·22	16·4
Skate Roads ...	,, 26	·40	—	—	12·00	4·20	—	16·0
Cambois Bay ...	July 4	·44	—	·59	5·41	1·90	—	8·3
Druridge Bay...	,, 11	·55	—	1·31	12·65	6·55	—	21·0
Alnmouth Bay	,, 25	·85	—	·49	14·30	9·94	—	25·4
Blyth Bay ...	,, 31	·17	—	2·00	10·67	5·33	—	18·1
Skate Roads ...	Aug. 5	·10	—	·30	7·50	1·30	—	9·2
Blyth Bay ...	,, 15	·42	—	2·11	6·10	10·00	—	18·0
Druridge Bay...	,, 22	·22	—	1·19	14·28	7·57	—	23·2
Alnmouth Bay	,, 29	·43	—	1·00	14·43	6·57	—	22·4
Cambois Bay & Blyth Bay	Sept. 5	·30	—	·40	7·10	3·30	—	11·0
All the Stations	1895 ..	·40	—	·87	10·63	5·25	·02	17·2
Skate Roads ..	,, ..	·25	—	.15	9·75	2·75	—	12·9
Druridge Bay...	,, ..	·43	—	1·05	13·30	5·24	·07	20·0
Alnmouth Bay	,, ...	·66	—	·72	14·36	8·39	—	24·2
Blyth Bay ...	,, ..	·32	—	2·06	7·87	8·20	—	18·4
	1894.							
Skate Roads ...	June 27	2·80	—	·10	37·10	2·20	1·90	44·3
Druridge Bay...	July 4	2·92	—	·54	15·78	5·84	·32	25·4
Alnmouth Bay	,, 11	2·12	—	·63	16·38	7·87	1·75	28·9
Blyth Bay ...	,, 27	·20	—	4·30	6·70	2·30	·20	13·7
Alnmouth Bay	,, 31	1·00	—	2·25	7·50	6·37	·50	17·6
Skate Roads ...	Aug. 6	1·80	—	·10	9·00	3·00	·90	14·8
Cambois Bay	,, 17	·12	—	2·50	2·25	1·38	·50	6·8
Druridge Bay...	,, 22	·76	—	3·89	5·41	4·32	·22	14·8
Alnmouth Bay	,, 29	1·75	—	1·00	8·13	4·37	·88	16·8
Cambois Bay ...	Sept. 13	·13	—	7·37	3·75	2·25	—	13·8
All the Stations	1894	1·39	—	2·21	11·62	3·92	·72	19·8
Skate Roads ..	,, ...	2·30	—	·10	23·05	2·60	1·40	29·5
Druridge Bay..	,, ...	1·84	—	2·22	10·59	5·08	·27	20·0
Alnmouth Bay	,, ...	1·62	—	1·29	10·67	6·21	1·04	20·8
Cambois Bay ...	,, ...	·12	—	4·94	3·00	1·81	·25	10·2

TABLE V.—Continued.

Catch of Flat Fish per hour's trawling.

Station.	1893.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Flat Fish.
ıbois Bay...	July 15	·25	—	·38	6·25	1·50	—	8·38
.nouth Bay	,, 25	1·13	—	1·00	14·50	12·50	—	29·13
h Bay ...	Aug. 2	·30	—	5·60	5·90	2·30	—	14·10
ıbois Bay...	,, 7	·40	—	1·60	6·00	5·10	—	13·10
nouth Bay	,, 22	·38	—	1·37	9·38	6·12	—	17·25
ridge Bay...	,, 31	·97	—	2·59	9·41	7·24	—	20·21
,, ...	Sept. 8	·76	—	3·03	7·89	1·22	—	15·90
h Bay ...	,, 13	·75	—	2·13	4·62	2·38	—	9·88
the Stations	1893 ...	·61	—	2·31	7·90	5·11	—	15·93
ıbois Bay...	,, ...	·33	—	1·06	6·11	3·50	—	11·00
nouth Bay	,, ...	·75	—	1·19	11·94	9·31	—	23·19
h Bay ...	,, ...	·50	—	4·06	5·33	2·33	—	12·22
ridge Bay...	,, ...	·86	—	2·81	8·65	5·73	—	18·05
	1892.							
th Bay ...	Aug. 1	—	—	·10	8·80	4·00	—	12·90
ıbois Bay...	,, 11	—	—	—	8·00	4·40	—	12·40
th Bay ...	,, 15	—	.10	—	2·00	1·20	—	3·30
ridge Bay...	Sept. 6	—	—	1·41	15·13	7·57	—	24·11
ıbois Bay...	,, 13	·30	—	·70	12·00	8·00	—	21·00
,, ...	,, 15	·20	—	·80	8·10	4·70	—	13·80
th Bay ...	,, 20	·20	—	·30	6·00	4·10	—	10·60
the Stations	1892 ...	·10	·02	·46	8·51	4·82	—	13·91
th Bay ...	,, ...	·07	·03	·13	5·60	3·10	—	8·93
ıbois Bay...	,, ...	·16	—	·50	9·37	5·70	—	15·73

TABLE VI.

The Mean Catch per hour of Plaice, at each Station, arranged in seven fortnightly periods.

SKATE ROADS.

Period.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	Max.	Mean.	Min.
I. ...	...	...	37·10	12·00	14·30	11·10	10·55	15·90	...	16·40	...	...	...	...	37·10	16·76	10·55
II. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
III. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
IV. ...	...	...	9·00	7·50	18·23	13·80	17·11	21·13	16·00	10·60	...	50·55	...	15·36	50·55	17·93	7·50
V. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
VI. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
VII. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mean ...	...	...	23·05	9·75	16·11	12·45	13·83	17·90	16·00	13·26	...	50·55	...	15·36	50·55	17·26	9·75

ALNMOUTH BAY.

I. ...	...	...	...	...	...	...	...	...	...	15·73	...	...	...	...	...	...	15·73	...
II. ...	...	...	...	16·38	...	...	7·25	14·63	9·50	...	...	16·80	12·93	40·85	10·11	40·85	16·06	7·25
III. ...	...	...	14·50	...	14·30	25·25	...	24·38	...	12·39	19·87	...	...	...	...	25·25	18·45	12·39
IV. ...	...	...	...	7·50	...	...	...	...	...	...	...	9·78	...	...	...	9·78	8·64	7·50
V. ...	...	...	9·38	...	...	19·25	31·63	...	...	18·67	34·84	...	10·07	...	11·30	34·84	19·30	9·38
VI. ...	...	...	...	8·13	14·43	...	...	...	30·12	...	...	15·48	...	15·49	...	30·12	16·73	8·13
VII. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mean ...	...	...	11·94	10·67	14·36	22·25	19·44	19·50	19·81	15·56	27·48	13·77	11·58	29·83	10·76	29·83	17·02	10·67

Period.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	Max.	Mean.	Min.
I. ...	...	...	...	13·33	...	...	11·35	...	13·93	...	...	...	...	...	13·93	12·87	11·35
II. ...	..	...	15·78	12·65	17·30	...	...	...	...	11·67	...	...	21·32	...	21·32	15·74	11·67
III. ...	...	...	...	...	...	13·95	7·57	6·76	...	...	22·62	11·22	...	11·22	22·62	12·22	6·76
IV. ...	...	...	...	...	16·97	...	...	...	12·81	10·44	...	..	24·24	11·11	24·24	15·71	10·44
V. ...	...	...	5·41	14·28	...	...	...	19·03	...	...	38·12	23·56	...	...	38·12	20·08	5·41
VI. ...	15·13	8·65	...	...	11·24	11·03	8·97	...	...	...	...	...	...	5·27	15·13	10·05	5·27
VII. ...	...	...	...	...	...	...	...	...	14·12	24·82	...	23·65	...	...	24·82	20·86	14·12
Mean ...	15·13	8·65	10·59	13·30	15·17	12·49	9·30	10·85	13·64	15·47	30·29	19·40	22·71	10·30	30·29	14·42	8·65

CAMBOIS BAY.

I. ...	...	...	...	...	. .	...	...	..	...	...	15·13	...	7·73	7·31	15·13	10·06	7·31
II. ...	...	...	...	5·41	9·67	10·40	...	...	4·42	5·82	9·95	8·10	...	...	10·40	7·68	4·42
III. ...	...	6·25	...	...	7·50	...	...	...	...	...	14·05	...	...	...	14·05	9·27	6·25
IV. ...	8·00	6·00	...	...	...	...	8·00	...	...	...	...	...	...	...	8·00	7·33	6·00
V. ..	...	...	2·25	...	7·60	9·54	...	12·60	...	...	...	...	7·04	2·10	12·60	6·85	2·10
VI. ...	...	...	...	...	...	...	...	16·20	...	19·23	...	12·63	...	16·50	19·23	16·14	12·63
VII. ...	10·05	...	3·75	...	...	...	...	...	...	...	...	...	..	...	10·05	6·90	3·75
Mean ...	9·37	6·11	3·00	5·41	8·00	10·06	8·00	13·89	4·42	13·08	12·94	10·31	7·42	7·73	13·80	9·09	3·00

BLYTH BAY.

I. ...	...	...	...	...	8·50	...	...	...	...	...	...	...	...	...	...	8·50	...
II. ...	...	...	...	...	...	...	25·75	...	29·70	5·50	...	...	...	...	29·70	20·32	5·50
III. ...	...	...	6·70	...	...	...	...	...	...	...	...	35·20	...	8·67	35·20	16·86	6·70
IV. ...	8·80	5·90	...	10·67	...	...	...	...	...	...	...	...	...	...	10·67	8·46	5·90
V. ...	2·00	...	...	6·10	...	15·71	...	...	...	...	...	...	23·61	5·25	23·61	10·53	2·00
VI. ...	...	...	...	...	6·30	...	...	20·00	...	...	...	30·67	...	...	30·67	18·99	6·30
VII. ...	6·00	4·62	...	...	...	...	...	...	...	...	41·43	...	...	...	41·43	17·35	4·62
Mean ...	5·60	5·33	6·70	7·87	7·40	15·71	25·75	29·00	29·70	5·50	41·43	33·05	23·61	7·72	41·43	13·40	5·33

TABLE VII.

The Mean Catch per hour of Dabs, at each Station, arranged in seven fortnightly periods.

SKATE ROADS.

Period.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	Max.	Mean.	Min.
I. ...	...	...	2·20	4·20	0·90	2·00	4·33	0·84	...	1·86	...	...	...	...	4·33	2·33	0·84
II. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
III. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
IV. ...	...	...	3·00	1·30	1·18	3·00	1·78	4·87	6·00	0·20	...	7·56	...	6·51	7·56	3·54	0·20
V. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
VI. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
VII. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mean ...	...	...	2·60	2·75	1·03	2·50	3.06	2·89	6·00	1·14	...	7·56	...	6·51	7·56	2·83	1·03

ALNMOUTH BAY.

I. ...	...	...	...	...	...	...	...	...	10·80	...	...	...	...	...	...	10·80	...
II. ...	...	...	7·87	...	...	7·75	7·38	9·50	...	...	16·53	13·60	3·96	7·42	16·53	9·25	3·96
III. ...	...	12·50	...	9·94	14·62	...	14·13	...	23·22	16·80	...	...	...	...	23·22	15·20	9·94
IV. ...	...	...	6·37	...	...	...	...	...	...	...	11·11	...	...	...	11·11	8·74	6·37
V. ...	...	6·12	...	...	5·50	5 37	...	...	17·47	14·32	...	12·74	...	8·91	17·47	10·06	5·37
VI. ...	...	...	4·37	6·57	...	...	...	17·38	...	...	12·90	...	6·32	...	17·38	9·51	4·37
VII. ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mean ...	...	9·31	6·21	8·39	10·06	6·56	10·75	13·44	17·23	15·54	13·36	13·19	5·42	5·73	17·23	10·60	5·42

Period.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1905.	1904.	1905.	Max.	Mean.	Min.
I. ...	...	...	...	1·67	...	...	9·84	...	7·17	...	...	...	...	...	9·84	6·23	1·67
II. ...	...	...	5·84	6·55	7·35	...	...	...	...	5·66	...	...	9·96	...	9·96	7·07	5·66
III. ...	...	...	...	...	...	3·67	16·22	6·76	...	...	13·15	11·89	...	10·67	16·22	10·39	3·67
IV. ...	...	...	...	...	7·36	...	...	...	14·60	18·78	...	...	20·00	12·89	20·00	14·73	7·36
V. ...	...	...	4·32	7·57	...	...	...	16·97	...	...	25·30	23·33	...	...	25·30	15·50	4·32
VI. ...	7·57	5·73	...	...	13·30	11·24	7·78	...	...	...	...	...	...	6·00	13·30	8·60	5·73
VII. ...	...	...	...	...	...	...	...	...	13·41	16·35	...	15·65	...	...	16·35	15·14	13·41
Mean ...	7·57	5·73	5·08	5·24	9·33	7·46	11·28	10·16	11·64	13·55	19·17	16·98	14·75	9·91	19·17	10·66	5·08

CAMBOIS BAY.

I. ...	...	...	...	...	...	...	...	...	...	...	11·88	...	12·80	6·07	12·80	10·25	6·07
II. ...	...	...	...	...	1·90	4·67	7·30	...	...	12·42	5·64	16·43	7·60	...	...	16·43	8·00	1·90
III. ...	...	...	1·50	...	...	...	...	...	...	...	...	10·81	...	...	...	10·81	5·90	1·50
IV. ...	4·40	5·10	...	...	...	...	11·71	...	...	...	...	...	...	...	...	11·71	7·07	4·40
V. ...	...	...	1·38	...	8·10	17·38	...	11·20	...	. .	...	...	11·40	18·25	18·25	11·78	1·38
VI. ...	...	...	...	...	...	...	...	8·80	...	11·85	...	10·63	...	9·00	11·85	10·07	8·80
VII. ...	6·35	...	2·25	...	...	...	...	...	...	...	...	...	...	...	6·35	4·30	2·25
Mean ...	5·70	3·50	1·81	1·90	6·33	11·27	11·71	10·40	12·42	9·00	13·10	9·08	13·53	10·86	13·53	8·52	1·81

BLYTH BAY.

I. ...	...	...	...	...	...	4·10	...	...	...	...	...	...	...	...	...	4·40	...
II. ...	...	...	...	...	...	...	...	16·75	...	8·16	4·50	...	...	...	...	9·90	4·50
III. ...	...	...	2·30	...	...	...	...	...	...	...	...	20·00	...	3·90	20·00	8·73	2·30
IV. ...	4·00	2·30	...	5·33	...	...	...	...	...	...	...	...	...	...	5·33	3·88	2·30
V. ...	1·20	...	...	10·00	...	10·00	...	...	...	...	...	...	9·81	9·50	10·00	8·11	1·20
VI. ...	...	...	...	...	7·80	...	...	19·00	...	...	...	18·07	...	...	19·00	14·96	7·80
VII. ...	4·10	2·38	...	...	...	...	...	...	...	...	12·71	...	...	...	12·71	6·40	2·38
Mean ...	3·10	2·33	2·30	8·20	6·10	10·00	16·75	19·00	8·46	4·50	12·71	19·09	9·84	5·45	19·09	7·24	2·30

TABLE VIII.

The Mean Catch per hour of Plaice and Dabs for all the Stations, arranged in seven fortnightly periods.

PLAICE.

Period.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	Max.	Mean.	Min.
I. ...	...	...	37·10	12·67	11·40	11·10	10·95	15·90	14·83	16·40	15·13	...	7·73	7·31	37·10	14·59	7·31
II. ...	...	...	16·08	9·03	13·49	8·83	20·19	9·50	17·06	7·66	13·38	10·52	31·09	10·11	31·09	13·91	7·66
III. ...	...	10·38	6·70	14·30	16·38	13·95	15·98	6·76	12·39	19·87	18·34	23·21	...	10·00	23·21	14·02	6·70
IV. ...	8·40	5·95	8·25	9·09	17·60	13·80	12·56	21·13	14·40	10·52	9·78	50·55	24·24	14·74	50·55	15·79	5·95
V. ...	2·00	9·38	3·83	10·19	13·43	18·96	...	15·82	18·67	34·84	38·12	16·81	15·33	6·22	38·12	15·66	2·00
VI. ...	15·13	8·65	8·13	14·43	8·77	11·03	11·03	22·11	...	19·23	15·48	21·65	15·49	10·89	21·65	14·00	8·13
VII. ...	8·03	4·62	3·75	...	...	...	...	...	14·12	24·82	41·43	23·65	...	...	41·43	17·20	3·75
Mean ...	8·51	7·90	11·62	10·63	13·47	13·58	13·44	14·33	15·51	16·71	19·83	21·63	20·17	9·99	21·63	15·00	7·90

DAB.

I. ...	...	...	2·20	2·94	2·65	2·00	7·09	0·84	8·99	1·86	11·88	...	12·80	6·07	12·80	5·39	0·84
II. ...	...	...	6·86	4·23	6·01	7·53	12·07	9·50	10·44	5·27	16·48	10·60	6·96	7·42	16·48	8·61	4·23
III. ...	...	7·00	2·30	9·94	7·31	3·67	15·18	6·76	23·22	16·80	11·98	15·95	...	7·29	23·22	10·62	2·30
IV. ...	4·20	3·70	4·69	3·32	4·27	3·00	6·75	4·87	10·30	9·49	11·11	7·56	20·00	9·70	20·00	7·34	3·00
V. ...	1·20	6·12	2·85	8·79	6·80	10·55	...	14·09	17·47	14·32	25·30	18·04	12·12	18·33	25·30	12·00	1·20
VI. ...	7·57	5·73	4·37	6·57	10·55	11·24	7·78	15·06	...	11·15	12·90	14·35	6·32	7·50	14·35	9·31	4·37
VII. ...	5·23	2·38	2·25	...	..	...	...	...	13·41	16·35	12·71	15·65	...	...	16·35	9·71	2·25
Mean ...	4·82	5·11	3·92	5·25	6·78	6·90	9·47	9·18	13·47	9·43	14·52	13·83	9·66	8·16	14·52	8·99	3·92

It will be convenient to rearrange the data with reference to plaice and dabs, and also with reference to station and the above fortnightly periods (Tables VI., VII. and VIII.), to indicate more graphically when the experiments were made in the successive years and the influence of seasonal variation.

The dates when Skate Roads was visited each year were as will be seen so closely identical that the results appear in the first and fourth periods. Unfortunately, however, it was not always possible to experiment in this area, especially in June. It is at once apparent that there were two occasions when the catches of plaice were abnormally large, viz.: in 1894 and in 1903. With these exceptions, which do not alter the conclusions with regard to the two periods, the experimental hauls appear to be typical of the station, and it is plain that while seasonal variation occurs, it is not usually a marked one. The small catches of dabs, so characteristic of this bay and Goswick Bay, are yet sufficiently consistent to justify the conclusion that they also are typical. It is worth noting here that while the catch of plaice referred to above in 1894 was not accompanied by a similar increase of dabs, that of 1903 was; and a comparison of the other results in the two tables will indicate that in some instances both showed an increase or decrease, in other the two forms exhibited more or less divergence in relative numbers.

The effects of seasonal varation are better illustrated by a comparison of the results obtained at the more southerly stations, but it is plain that the limits of variation do not exceed what would be expected from areas liable to gain and loss from the areas immediately outside.

Alnmouth Bay was experimented in on three occasions, in 1894, 1900, and 1902, and in the case of plaice the returns point to an emigration in July, followed by an immigration in August. The catches of dabs also exhibit similar gains and losses, but the seasons are not always coincident with those noted for plaice. In the case of the three visits in the years mentioned above, for example, the numbers recorded for dabs indicate almost exactly opposite periods of increase and decrease compared with plaice.

Experiments have been made in Druridge Bay with great regularity during the 14 years, and the effects of emigration and immigration on the catches are apparent from a consideration of the returns. The evidence shows in the first place that there is variation in the incidence of the immigration, and gives reason in

the second for concluding that the immigration takes place later usually than that of Alnmouth Bay. This is apparently the case also with regard to Cambois Bay and Blyth Bay.

Attention has been drawn before, in previous reports, to the increase in numbers of the common flat fish during the short period of the experimental season, and that such an increase was sometimes correlated with the appearance so near the shore as our trawling stations of off-shore mature plaice. This is rendered all the more evident when the results are brought together for the first two months and the last two months of the season. (Table IX. and Chart 3.)

The experiments thus demonstrate that an enrichment and subsequent loss occurs every season, that in fact there is emigration to the offshore grounds, followed by an immigration, and that the intensity of the immigration, and the period when it takes place, varies with the season. It has to be noted, likewise, that the two dominant species are not always similarly affected. In some cases both may show an increase or decrease, and in other cases one may have improved in numbers and the other decreased.

When the results are combined, as they have been in Table VIII., seasonal variation is more or less masked from the fact that the experiments have been made at different times during the season in successive years. In the case of plaice this is so markedly the case that the large number of experiments taken together may reasonably be held to be typical of the Northumberland area. Furthermore, it has to be stated that in no case can a variation in the form of the experiment be appealed to in explanation of returns which are much above or below the mean. I have no hesitation in concluding that on these occasions the plaice or the dabs were actually present in excessive or small numbers. As was pointed out in the report for 1902, p. 23, the experiments are not liable to be affected by such circumstances as may be suggested would produce variation. Because "(1) They have been conducted for over ten years [now for fourteen years]. (2) The season during which they are made is short,—from about the end of June to the beginning of September. (3) The experiment is made long enough to cover at least one phase of the tide. By the latter statement is meant that during the time the experiment is being conducted the tide more or less ebbs and flows. (4) Very little line fishing takes place in these bays, and practically none at all during the season of our experiments, and trawling is prohibited." In short, the elements of variation which may be suggested would affect the results are covered by the conditions of the experiment.

TABLE IX.

The Catches per hour of Soles, Plaice, Dabs, each year (*a*) in June/July, and (*b*) in August/September.

1.—COMPLETE EXPERIMENT.

Year.	Sole.	Plaice.	Dab.
1893 *a*	·69	10·38	7·00
b	2·72	7·20	4·56
1894 *a*	1·56	16·69	4·91
b	2·97	5·71	3·06
1895 *a*	·84	11·39	4·93
b	1·00	9·88	5·75
1896 *a*	1·80	14·21	5·61
b	2·03	12·50	7·17
1897 *a*	1·99	10·67	5·18
b	1·33	16·34	7·17
1898 *a*	·70	15·70	11·44
b	·48	25·45	6·43
1899 *a*	·10	10·36	4·23
l	·18	19·85	13·04
1900 *a*	1·59	15·23	12·41
b	2·45	15·40	12·87
1901 *a*	·89	12·28	7·87
b	·70	22·37	10·68
1902 *a*	2·19	14·72	13·32
b	3·33	31·68	16·97
1903 *a*	6·95	14·66	11·04
b	4·59	25·19	14·66
1904 *a*	4·56	23·30	8·91
b	2·89	17·60	12·64
1905 *a*	2·07	9·33	7·01
b	3·65	9·98	9·44

2.—FIRST HAUL.

Year.	Plaice.	Dab.
1899 *a*	14·50	27·06
b	63·78	24·49
1900 *a*	55·26	24·59
b	68·80	53·12
1901 *a*	70·45	24·53
b	66·88	22·71
1902 *a*	56·64	68·07
b	117·12	81·25
1903 *a*	56·24	44·78
b	50·55	82·34
1904 *a*	36·34	44·01
b	38·29	50·04
1905 *a*	33·81	22·64
b	27·39	64·21

TABLE X.

Proportional Catches of Flat Fish.

A.—COMPLETE EXPERIMENT.

Stations.	Years.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder
All the Stations ...	14	3·83	·21	7·94	53·57	32·18	2·27
Goswick Bay ...	3	3·08	1·71	·86	83·56	7·36	3·43
Skate Roads ...	9	9·75	·86	·83	71·03	11·65	5·88
Alnmouth Bay ...	13	3·22	·10	6·02	53·77	33·45	3·44
Druridge Bay ...	14	3·89	·17	7·86	50·25	37·17	·66
Cambois Bay ...	14	1·63	·06	15·17	42·42	39·76	·96
Blyth Bay	14	1·59	·08	9·11	56·65	30·59	1·98

B.—FIRST HAUL.

All the Stations ...	7	1·20	·14	2·73	49·23	41·53	5·17
Goswick Bay ...	3	1·75	1·32	·44	83·77	3·07	9·65
Skate Roads ...	7	3·12	·48	·32	82·91	9·84	3·33
Alnmouth Bay ...	7	·81	...	2·57	41·66	43·01	11·95
Druridge Bay ...	7	1·09	·08	3·30	42·88	51·90	·75
Cambois Bay ...	7	·43	·04	4·32	34·57	55·60	5·04
Blyth Bay	6	·56	·19	2·53	52·63	39·59	4·50

TABLE XA.

Proportional Catches of Flat Fish.

A.—COMPLETE EXPERIMENT.

Year.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.
1892	·73	·10	3·32	61·16	34·69	...
1893	3·83	...	14·51	49·60	32·06	...
1894	7·00	...	11·15	58·47	19·74	3·64
1895	2·32	...	5·08	61·86	30·62	·12
1896	5·15	·08	7·69	55·82	28·10	3·16
1897	7·53	·54	6·77	54·76	27·80	2·60
1898	4·30	·60	1·96	53·24	37·51	2·39
1899	2·45	·20	3·10	55·93	35·82	2·50
1900	1·57	·22	6·07	47·91	41·63	2·60
1901	3·11	·49	3·03	58·36	32·92	2·09
1902	1·30	·11	6·62	52·12	38·17	1·68
1903	3·58	·27	14·44	48·58	31·06	2·07
1904	2·47	·08	10·14	56·25	26·94	4·12
1905	8·64	·10	12·00	42·45	34·69	2·12

B.—FIRST HAUL.

1899	·78	...	1·17	45·61	46·68	5·76
1900	·87	·13	1·81	55·01	31·35	10·83
1901	1·23	·26	1·03	69·35	23·55	4·58
1902	·32	·10	1·60	49·81	44·04	4·13
1903	1·09	·26	5·62	41·88	49·30	1·85
1904	3·37	·19	4·31	38·24	46·49	7·40
1905	1·80	...	4·61	34·97	56·51	2·11

2.—Character of the Stations.

As was pointed out last year in the paper on the Crab and Lobster fisheries of Northumberland, the hard ground is much more extensive in the northern part of the district, and my colleague, Professor Lebour, kindly indicated, as far as it was possible, the geological nature of the undersea extensions of the land formations. It was shown likewise that this was the most obvious reason for a remarkable disproportion in the population of crabs in the two divisions of the Committee's district. Two of the trawling stations are situated in the northern division, viz.: Goswick Bay and Skate Roads. Outside these stations, which lie one to the north and the other to the south of Holy Island, are considerable areas of rocky or hard ground. Whether this be the reason or not, it is the fact that they offer a marked contrast to the rest of the trawling stations in the proportion of the fishes. (Table X. and Chart 1.) The dominant species of flat fish are plaice and dabs, and it is evident that both the first haul and the complete experiment agree in demonstrating a large proportion of plaice (about 80 %), and a small proportion of dabs (about 10 %). The mean proportion for the district (including one of the northern stations—Skate Roads) for plaice is about 50 %, and for dabs about 35 %.

A gradual but slight decrease from Ahmouth Bay (which lies immediately on the southern boundary of the extensive northern hard ground) to Cambois Bay is indicated, with a rise again at Blyth Bay, the most southerly of all the stations. It is possible to show that the latter bay is more shut in from the seaward side by hard ground than Cambois Bay and Druridge Bay.

Dabs on the other hand gradually increase in proportion from north to south, decreasing again in Blyth Bay.

Some such differences may be traced also with regard to the prime fish. Turbot tend to decline in proportion from north to south, and soles even more strikingly present an increasing proportion from north to south, reaching a maximum in Cambois Bay. The ground in the northern part of the district which favours the turbot is also clearly the ground which suits its near and rare ally in inshore waters, the brill.

These differences between the stations are again clearly demonstrated in Tables V., VI., and VII., and in the diagrams in Chart 2. Skate Roads, the northern station represented, stands alone amongst those depicted in the small proportion

of dabs. It will be seen, moreover, that the numbers of plaice which may be caught in an hour gradually decrease from north to south in our district, rising however again at the most southern station, Blyth Bay. Among the southern stations, dabs may also be said to decrease slightly from north to south including Blyth Bay. The two prime fish, turbot and sole, are directly opposite in this respect, the sole increasing towards the south and the turbot towards the north.

The diagrams show the approximation of the lines representing the catches of the plaice and dabs, and that as a matter of fact in Cambois Bay the dab has been during the period, or at all events since about 1897, predominant. A consideration of the evidence of the first haul will prove that the dab is even more prominent in the southern area than those figures indicate (p. 41).

The differences between the stations, and especially between the northern and southern divisions of the county, only apply to areas near to the shore at various parts of the coast. The results will be compared presently with the experiences of the fishermen (p. 67).

3.—Annual Variations.

The more important results as set forth in Table V. are expressed in diagram-form in Chart 2. It is at once apparent from a consideration of the tables and the diagrams that the experimental hauls point to a gradual but distinct improvement in flat fish having taken place in the regions experimented in during these fourteen years. The various stations also indicate the general increase in the numbers of flat fish, and that means especially of plaice and dabs.

It has been natural for us in the light of these experiments as the results have become manifest from year to year to correlate the increase with the passing of the byelaw prohibiting trawling in the Northumberland area. The byelaw came into force in 1891, and the experiments commenced in 1892. Any other explanation does not, at all events, so readily occur to us. It may be suggested, however, that our experiments show merely that a wave of plenty reaching a maximum in 1903 has characterised the period, and that it is now showing signs of an inevitable decline. If this is the case, then such a normal gradual increase has taken place during some twelve years. As the experiments are to be continued, it will soon be apparent whether such a continuous diminution in numbers will

ake place in the next few years, and if so, if this is a probable xplanation of the gain and loss to the flat fish population of the Northumberland area. Or, again, it may be said that the decline n the inshore fisheries has, perhaps, more to do with the explana- ion than the prevention of trawling. On this point, however, I hall have more to say in a following section (p. 82.)

Whatever the reason or reasons, the experiments indicate that p to 1903 the district as a whole has yielded a gradually increasing atch of flat fish per hour's trawling. Since 1903, that is during he last two years, the experimental catches show that a great fall- ng off has taken place. It has had the effect of bringing the catch f plaice for the area below the mean of the period of 14 years, and f dabs to about the mean.

The five principal stations exhibit interesting differences, how- ver, in the results for the period. Especially striking is the con- rast between the northern station, Skate Roads, and the southern tations. It will be seen that at Skate Roads practically no change n the catch per hour of plaice took place until 1903, when a very arge catch was made, followed by as great a decrease in 1905.

At Alnmouth Bay the catches of plaice show that considerable uctuations have occurred during the last five years. Those of dabs oint to an increase up to 1900, followed by a decline to 1904 and 905.

The results for Druridge Bay are more like the mean results for he whole area. The catches of both plaice and dabs have, more- ver, at this bay closely followed one another. Both have increased, nd lately decreased in numbers from year to year in much the ame manner, although it must be remembered that the season of ne increase or decrease does not always or commonly coincide. 'his parallelism in annual variation of the two dominant species s true also of the district. (Compare diagrams 1 and 4, Chart 2.)

At Cambois Bay, fluctuations within narrow limits show that ractically no change has taken place, except that during the first ew years there was a very small catch per hour of plaice and dabs.

In this case, moreover, it is clear that the plaice and dabs have ot always increased or decreased in the same years.

Considerable variation is evident at Blyth Bay, but on the whole ne catches point to a gradual improvement to 1902 for plaice and o 1903 for dabs. The evidence for the latter bay has not been

considered so trustworthy, however, from the fact that usually bad weather and a stormy sea made the choice of this bay adjacent to the port of Blyth inevitable.

These considerations show that were we to leave out Skate Roads and Blyth Bay, the general conclusions with regard to the results of the experiments would not suffer. In the meantime, the question may be left with the statement that plaice and dabs have been caught at the experiments in gradually increasing numbers up to 1902-3, since when there has been a falling off.

But it is reasonable, all the same, to conclude from what we now know with regard to the migration of the flat fish, that such a protection to the small immature fish, reared in the district, as is afforded by the byelaw prohibiting trawling would inferentially increase the population of fish which do not leave the area.

The previous analysis into fortnightly periods, and especially the facts presented in Table IX. (see Chart 3) show also that in the case of plaice especially, the improvement which has been experienced during the period of investigation is brought about mainly by the August-September immigration into the regions where the stations are situated.

First Haul. 4.—Distribution of Flat Fish.

During the first two or three years I was connected with the experiments, notes were made as to the numbers of the smaller sizes of fish captured, but from 1899 the fish caught in the first haul have been measured and recorded completely. It was tried to make this haul of an hour's duration, and where this was not possible, the figures, as those for the complete experiment, have been reduced to that standard. They are set forth in Table XI., and are expressed likewise in Chart 2.

As was pointed out in the report for 1901, the first haul is not always in agreement with the complete experiment, but with reference to the relative numbers of the flat fishes, it has to be recalled that while the latter deals with the marketable fishes, the former is made to record the total number of each species caught by the trawl. The complete experiments refer to the results obtained in from six to ten hours' trawling, and to fish chosen in a rule of thumb method as 'marketable,' the first haul gives the exact number, and the sizes of all the fish which are caught in about an hour's trawling.

Catch per hour's Trawling.—First Haul.

GOSWICK BAY.

Year.	Date.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fish.	Gurnard.	Cod.	Whiting.	Cole Fish.	Skate.	Angler.	Weever.	Lump-sucker.	Dragonet.	Armed Bullhead.	Total.	Grand Total.
1899	June 23...	—	—	—	26·00	·67	1·33	28·00	—	—	—	—	—	—	—	—	—	—	—	28·00
1901	June 28...	4·00	1·00	—	131·00	3·00	20	162·00	2·00	—	—	—	—	2·00	—	1·00	—	1·00	6·00	168·00
1903	June 26...	—	2·67	1·33	24·00	4·00	—	32·00	1·33	—	—	—	1·33	10·67	—	—	—	—	13·33	45·33
Mean catch per hour		1·23	·92	·31	58·77	2·15	6·77	70·15	·92				·31	3·08		·31		·31	4·93	75·08

TABLE XI.—Continued.—SKATE ROADS.

Year.	Date.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fish.	Gurnard.	Cod.	Whiting.	Cole Fish.	Skate.	Angler.	Weever.	Lump-sucker.	Dragonet.	Armed Bullhead.	Total.	Grand Total.
1899	June 21...	—	—	—	16·00	1·60	1·60	19·20	—				—	—					—	19·20
,,	Aug. 7...	1·60	—	—	65·60	8·80	1·60	77·60	·80				—	·80					1·60	79·20
,,	Total ...	·80	—	—	40·80	5·20	1·60	48·40	·40				—	·40					·80	49·20
1900	Aug. 6...	—	—	2·00	138·00	10·00	1·00	151·00	3·00				2·00	1·00					6·00	157·00
,,	Sept. 17...	3·00	1·00	—	79·00	18·00	—	101·00	4·00				1·00	—					5·00	106·00
,,	Total ...	1·50	·50	1·00	108·50	11·00	·59	126·00	3·50				1·50	·50					5·50	131·50
1901	June 10...	2·40	—	—	89·60	8·80	—	100·80	2·40				1·60	—					4·00	104·80
,,	,, 26...	5·14	·86	—	119·14	12·00	7·71	174·85	6·86				—	1·71					8·57	183·42
,,	,, 28...	2·25	·75	—	152·25	6·00	1·50	162·75	1·50				—	·75					2·25	165·00
,,	Aug. 6...	4·80	·80	—	71·20	3·20	·80	80·80	·80				—	·80					1·60	82·40
,,	Total ...	3·60	·60	—	115·60	7·40	2·40	129·60	2·80				·40	·80					4·00	133·60
1902	June 26...	—	—	—	50·00	5·00	7·00	62·00	—				—	—					—	62·00
,,	July 30...	1·00	2·00	—	185·00	18·00	6·00	212·00	1·00				—	—					1·00	213·00
,,	Sept. 3...	3·00	—	3·00	64·50	15·00	4·50	90·00	25·50				—	4·50					30·00	120·00
,,	Total ...	1·12	·75	·75	104·25	12·38	6·00	125·25	6·75				—	1·12					7·87	133·12
1903	June 25...	—	—	—	79·00	14·00	8·00	101·00	—				—	—					—	101·00
,,	,, 26...	·86	·86	—	63·43	1·71	6·85	73·71	—				—	—					—	73·71
,,	Aug. 4...	2·82	1·41	1·41	79·76	31·06	·71	117·17	5·65				—	·71					6·36	123·53
,,	Total ...	1·40	·81	·56	74·23	16·74	4·74	98·51	2·23				—	·28					2·51	101·02
1904	Aug. 1...	21·00	—	—	24·00	4·00	1·00	50·00	—				—	—					—	50·00
1905	June 29...	—	—	—	38·40	4·80	10·80	54·00	—				—	—					—	54·00
,,	Aug. 7...	6·00	—	—	45·00	4·00	2·00	57·00	3·00				—	1·00					4·00	61·00
,,	Total ...	3·27	—	—	42·00	4·36	6·00	55·63	1·64				—	·54					2·18	57·81
Mean catch 12 hour		3·13	·48	·32	89·98	9·85	3·32	100·09	2·74				·26	·60					3·60	103·69

Year.	Date.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fish	Gurnard.	Cod.	Whiting.	Cole Fish.	Skate.	Angler.	Weever.	Lump-sucker.	Dragonet.	Armed Bullhead.	Total.	Grand Total.
1899	July 5..	—		—	19·33	46·00	12·00	77·33	·67	·66	—			2·00					3·33	80·66
,,	Sept. 6...	·80		—	71·40	32·00	22·10	129·60	15·20	—	—			—					15·20	144·80
,,	Total ...	·36		—	44·36	39·64	16·73	101·09	7·27	·36	—			1·09					8·72	109·81
1900	June 29...	—		·86	72·00	32·57	29·11	134·57	29·11	—	·86			3·13					33·13	168·00
,,	July 25...	·75		2·25	36·75	31·50	38·25	109·50	96·00	—	·75			5·25					102·00	211·50
,,	Aug. 11...	·86		1·29	66·00	18·86	31·28	151·29	105·43	—	—			3·13					108·86	263·15
,,	Total ...	·55		2·15	57·27	37·36	34·09	131·72	77·73	—	·51			1·09					82·36	214·08
1901	July 21...	—		1·00	23·00	30·00	3·00	57·00	1·00	—	—			—					1·00	58·00
,,	Aug. 11...	—		1·00	132·00	13·00*	42·00	218·00	2·00	—	—			—					2·00	220·00
,,	Total ...	—		1·00	77·50	36·50	22·50	137·50	1·50		—			—					1·50	139·00
1902	July 9...	—		2·00	55·00	120·00	—	177·00	281·00	—	—			7·00					288·00	465·00
,,	,, 30 ..	—		2·57	71·57	94·29	18·09	189·43	107·11	—	—			—					107·11	296·57
,,	Aug. 27...	3·00		3·00	76·00	135·00	1·00	221·00	36·00	—	—			10·00					46·00	267·00
,,	Total ...	·95		2·53	68·84	115·26	7·89	195·47	139·58	—	—			5·37					111·95	340·42
1903	July 1...	2·00		8·00	46·00	37·00	2·00	95·00	5·00	—	—			3·00					8·00	103·00
,,	Aug. 19...	3·00		11·00	30·00	68·00	1·00	113·00	66·00	—	—			9·00					75·00	188·00
,,	Total ...	2·50		9·50	38·00	52·50	1·50	101·00	35·50	—	—			6·00					41·50	115·50
1904	July 13...	—		6·00	32·00	21·00	2·00	61·00	—	—	—			5·00					5·00	66·00
,,	Sept. 7...	4·00		7·00	11·00	37·00	17·00	106·00	2·00	—	—			—					2·00	108·00
,,	Total ...	2·00		6·50	36·50	29·00	9·50	83·50	1·00	—	—			2·50					3·50	87·00
1905	July 12...	·80		2·40	28·00	26·10	1·60	59·20	24·60	—	—			8·80					30·40	89·60
,,	Aug. 16...	2·00		3·00	35·00	71·00	—	111·00	4·00	—	—			17·00					21·00	135·00
,,	Total ...	1·33		2·67	31·11	47·56	·89	83·56	13·78	—	—			12 11					26·22	109·78
Mean catch P hour		1·01		3·20	51·81	53·50	14·86	124·38	47·89	·05	·11			1·49					52·54	176·92

* Including one Lemon Dab.

TABLE XI.—Continued.—DRURIDGE BAY.

Year.	Date.	Turbot.	Brill.	Sole	Plaice.	Dab.	Flounder.	Total Flat Fish.	Gurnard.	Cod.	Whiting.	Cole Fish.	Skate.	Angler.	Weever.	Lump-Sucker.	Dragonet.	Armed Bullhead.	Total.	Grand Total.
1889	July 19...	—	—	—	4·00	14·00	·67	18·67	4·00	—	—	—	–	·67	–		–		4·67	23·34
,,	,, 26...	1·33	—	·67	18·67	46·66	—	67·33	10·66	—	—	—	–	2·67	–		–		13·33	80·66
,,	Aug. 23...	·67	—	2·00	51·33	32·67	1·33	88·00	14·00	—	—	—	–	–	–		–		14·00	102·00
,,	Total ...	·67	—	·89	24·67	31·11	·66	58·00	9·56	—	—	—	–	1·11	–		–		10·67	68·67
1900	June 20...	2·57	—	·86	61·71	14·57	·86	80·57	13·72	—	—	—	–	1·71	–		–		15·43	96·00
,,	Aug. 1...	1·00	—	2·00	79·00	52·00	—	134·00	92·00	—	1·00	1·00	–	–	–		–		94·00	228·00
,,	,, 6...	·86	—	1·71	48·86	16 28	·86	68·57	5·14	—	—	—	–	–	–		–		5·14	73·71
,,	Sept. 12...	—	—	7·39	46·15	66·46	—	120·00	37·85	—	—	—	–	2·76	–		·92		41·53	161·53
,,	Total ...	1·13	—	2·94	58·42	36·23	·45	99·17	35·09	—	·23	·23	–	1·13	–		·22		36·90	136·07
1901	July 10...	—	—	2·82	21·88	11·30	·71	36·71	4·94	—	—	—	–	–	–		–		4·94	11·65
,,	,, 31...	—	—	1·85	28·61	80·31	—	110·77	4·61	—	—	—	–	·92	–		–		5·53	116·20
,,	Sept. 4...	—	—	·86	22·28	12·86	·86	36·86	5·14	—	—	—	–	–	–		–		5·14	42·00
,,	,, 12...	—	—	2·40	92·80	31·20	·80	127·20	6·40	—	—	—	–	3·20	–		–		9·60	136·80
,,	Total ...	—	—	2·03	41·49	31·93	·61	76·07	5·29	—	—	—	–	1·01	–		–		6·30	82·37
1902	July 16...	1·00	—	1·00	47·00	53·00	—	102·00	47·00	—	—	—	–	8·00	–		–		55·00	157·00
,,	Aug. 20...	—	—	3·00	143·00	157·00	1·00	304·00	62·00	1·00	—	—	–	5·00	–		–		68·00	372·00
,,	Total ...	·50	—	2·00	95·00	105·00	·50	203·00	54·50	·50	—	—	–	6·50	–		–		61·50	264·50
1903	July 15...	2·00	1·00	12·00	51·00	84·00	5·00	155·00	36·00	—	—	—	–	1·00	1·00		–		38·00	193·00
,,	Aug. 12...	1·00	—	7·00	30·00	174·00	—	212·00	55·00	—	—	—	–	2·00	–		–		57·00	269·00
,,	Sept. 9...	1·85	—	10·15	29·54	72·00	—	113·54	11·08	—	—	—	·92	1·84	–		–		13·84	127·38
,,	Total ...	1·62	·32	9·73	36·65	108·97	1·62	158·91	33·41	—	—	—	·32	1·62	·32		–		35·67	194·58
1904	July 6...	1·71	·86	3·43	47·14	48·86	1·71	103·71	18·00	—	—	—	–	–	–		–		18·00	121·71
,,	Aug. 10...	6·00	—	1·00	39·00	74·00	2·00	122·00	2·00	—	—	—	–	2·00	–		–		4·00	126·00
,,	Total ...	3·69	·46	2·31	43·38	60·16	1·85	112·15	10·62	—	—	—	–	·92	–		–		11·54	123·69
1905	July 19...	—	—	4·00	25·00	28·00	—	57·00	8·00	—	—	—	–	8·00	–		–		16·00	73·00
,,	Aug. 2...	2·00	—	3·00	14·00	46·00	—	65·00	2·00	—	—	—	–	16·00	–		–		18·00	83·00
,,	Sept. 6...	2·00	—	6·00	18·00	35·00	—	61·00	57·00	—	—	—	–	4·00	–		–		61·00	122·00

Year.	Date.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fish.	Gurnard.	Cod.	Lythe.	Whiting.	Cole Fish.	Skate.	Angler.	Weever.	Dragonet.	Armed Bullhead.	Total.	Grand Total.
1899	Aug. 16...	·66	–	1·00	32·00	112·67	2·00	151·33	16·67	–	–	–		–	·66	–	–	–	17·33	168·66
,,	,, 30...	·80	–	1·60	67·20	37·60	2·40	109·60	16·00	–	–	–		–	–	–	–	–	16·00	125·60
,,	Total ...	·73	–	2·91	18·00	78·51	2·18	132·36	16·37	–	–	–		–	·36	–	–	–	16·73	149·09
1900	July 11...	1·33	·67	1·33	18·00	53·33	18·67	93·33	28·67	–	–	–		–	–	–	–	1·33	30·00	123·33
1901	,, 3...	·67	–	·67	28·66	23·33	1·00	57·33	25·33	–	–	·66		–	·67	·67	·67	–	28·00	85·33
,,	Aug. 28...	–	–	1·00	71·00	38·00	1·00	111·00	–	–	–	3·00		–	–	–	–	–	3·00	111·00
,,	Sept. 4...	–		–	12·00	8·00	–	20·00	1·00			–		–	–	–	–	–	1·00	21·00
,,	Total ...	·29		·57	36·00	23·11	2·00	62·00	11·11	–	–	1·11		–	·29	·29	·28	–	13·11	75·14
1902	June 28...	–	–	1·00	73·00	57·00	19·00	153·00	37·00	–	–	–		–	12·00	–	–	–	19·00	202·00
,,	July 2...	–	–	1·00	101·00	131·00	20·00	259·00	11·00	–	–	–		–	15·00	–	–	–	29·00	288·00
,,	,, 23...	–	–	8·00	108·00	99·00	9·00	221·00	41·00	–	–	2·00		–	3·00	–	–	–	16·00	240·00
,,	Total ...	–	–	5·33	95·00	95·67	16·00	212·00	20·67	–	–	·66		–	10·00	–	–	–	31·33	213·33
1903	July 9...	–	–	21·00	22·00	31·00	1·00	75·00	–	–	–	–		1·00	–	–	–	–	1·00	76·00
,,	Aug. 26...	–	–	8·00	38·00	116·00	–	162·00	23·00	–	1·00	1·00		1·00	1·00	–	–	–	27·00	189·00
,,	Total ...	–	–	11·50	30·00	73·50	·50	118·50	11·50	–	·50	·50		1·00	·50	–	–	–	14·00	132·50
1904	June 21...	·80	–	9·60	32·80	16·10	1·60	91·20	19·20	–	–	–		–	1·00	–	–	–	23·20	111·10
,,	July 20...	–	–	–	15·23	113·08	21·23	209·51	–	–	–	1·62		–	3·69	–	–	–	8·31	217·85
,,	Aug. 21...		–	10·00	11·00	39·00	–	60·00	10·00			–		1·00	–	–	–	–	11·00	71·00
,,	Total ...	·30	–	6·60	30·30	75·60	7·50	120·30	10·20	–		1·50		·30	2·70	–	–	–	14·70	135·00
1905	June 30...	2·00	–	2·00	27·00	18·00	2·00	51·00	2·00	–	-	–		–	18·00	–	–	–	20·00	71·00
,,	Aug. 23...	·86	–	6·00	11·14	91·71	–	109·71	3·13	–	-	–		–	12·86	–	–	–	16·29	126·00
,,	Sept. 1...	1·00	–	7·00	21·00	21·00	1·00	57·00	11·00	1·00	-	–		–	–	–	–	–	15·00	72·00
,,	,, 13...	–	–	6·00	11·00	89·00	–	109·00	26·00	–	-	–		–	1·00	–	–	–	27·00	136·00
,,	Total ...	·96	–	5·28	18·72	57·12	·72	82·80	11·01	·21	-	–		–	8·16	–	–	–	19·41	102·24
Mean catch P hour		·19	·05	4·99	39·95	61·25	5·83	115·56	14·12	·05	·05	·59		·15	3·75	·05	·05	·10	19·21	134·77

TABLE XI.—Continued.—BLYTH BAY.

Year.	Date.	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fish.	Gurnard.	Cod.	Whiting.	Cole Fish.	Skate.	Angler.	Weever.	Lump-Sucker.	Dragonet.	Armed Bullhead.	Total.	Grand Total.
1900	July 4...	—	—	—	50·57	19·71	·86	71·14	—	—	—			2·57	·86		·86	—	4·29	75·43
,,	Sept. 5...	2·00	—	2·00	104·00	82·00	10·00	200·00	50·00	—	2·00			—	4·00		2·00	2·00	60·00	260·00
,,	Total ...	·60	—	·60	66·60	38·40	3·60	109·80	15·00	—	·60			1·80	1·80		1·20	·60	21·00	130·80
1901	July 3...	—	1·20	2·40	14·40	20·40	4·80	43·20	4·80	—	—			—	—		—	1·20	6·00	49·20
1902	Sept. 11...	—	—	6·00	138·00	78·00	—	222·00	2·40*	2·40	—			8·40	—		—	—	13·20	235·20
1903	July 23...	—	—	6·00	76·00	101·00	1·00	184·00	10·00	—	—			11·00	—		—	—	21·00	205·00
,,	Sept. 2...	3·00	—	3·00	96·00	33·00	3·00	138·00	16·50	—	—			1·50	—		—	—	18·00	156·00
,,	Total ...	1·20	—	4·80	84·00	73·80	1·80	165·60	12·60	—	—			7·20	—		—	—	19·80	185·40
1904	June 30...	1·71	—	4·29	12·86	2·57	1·71	23·14	—	—	—			—	—		—	—	—	23·14
,,	July 20...	—	1·09	—	48·00	2·18	22·91	74·18	—	—	—			—	—		—	—	—	74·18
,,	Aug. 17...	—	—	1·09	62·18	50·18	7·64	121·09	36·00	—	—			1·09	—		—	—	37·09	158·18
,,	Total ...	·67	·33	2·00	38·67	17·00	10·00	68·67	11·00	—	—			·33	—		—	—	11·33	80·00
1905	July 26...	1·33	—	2·66	50·67	36·00	6·67	97·33	10·67	2·66	—			4·00	—		—	—	17·33	114·66
,,	Aug. 23...	—	—	6·00	58·00	150·00	—	214·00	12·00	—	—			26·00	—			—	38·00	252·00
,,	Total ...	·80	—	4·00	53·60	81·60	4·00	144·00	11·20	1·60	—			12·80	—		—	—	25·60	169·60
Mean catch p hour		·65	·22	2·92	60·65	45·62	5·19	115·25	10·70	·43	·11			4·21	·32		·22	·22	16·21	131·46

* Sapphirine Gurnard.

It is worth noting, therefore, in trying to understand the marked superiority of the dabs according to the evidence of the first haul, that this species presents a smaller proportion of sizes compared with plaice which would be accounted marketable. Our reports show that they are present in large numbers from about 4 to 5 inches, and were the meshes of the net fine enough many still smaller would also be caught. The marketable dabs occur in greater numbers in moderate depths outside our stations.

For reasons such as these then I am disposed to take the evidence of the first haul, as I pointed out more fully in the report for 1901, for an approximately accurate indication, not only of the relative numbers of the fish which are liable to be caught by such a net as that we have employed, but of the proportional numbers actually present above a certain size. In our district, therefore, so near the shore as our trawling stations, when the smaller sizes of these species are taken into consideration, the dab at once advances into a place of prominence as a member of the flat fish fauna of the southern area. The dab becomes also more predominant in this area towards the south, suffering, however, a regression in Blyth Bay. It would appear, moreover, that a change has taken place in quite recent years favouring the dab, since, in fact, about 1901. But similar, if less prominent, improvements appear to have taken place in the earlier years of the experiments. It is well to note also that the first haul indicates even more strongly than the complete experiment the conditions which have been mentioned with regard to the northern stations. (See Skate Roads.)

The fish population of the sandy bays of the Northumberland coast may thus be divided into two main groups, a northern and a southern, and these again run into minor local peculiarities.

A short experiment which was made in Blackpool Bay, near Hartlepool, on 2nd August, 1897, gives an opportunity of instituting comparison in this respect with a district to the south. In 2½ hours in the early morning, in foggy weather, the catch obtained, reduced to the standard of one hour's trawling, was :—

	Turbot.	Brill.	Sole.	Plaice.	Dab.	Flounder.	Total Flat Fish.	Gurnard	Total.
per hour, marketable	...	...	1·6	19·6	7·6	...	28·8	...	...
tion, marketable ...	...	...	5·55	68·06	36·39	...	100	...	...
tion, total catch ...	...	...	1·05	57·37	51·58	...	100	...	...
per hour, total catch	...	...	1	15	49	...	95	33	128

It is plain from these figures that Blackpool Bay is very like Druridge Bay in our district with regard to the proportion of flat fish, and that, therefore, there is no sign that the gradual changes, to which attention has been drawn, are continued towards the south.

The experiments of the Scottish Fishery Board in the areas immediately to the north show that the various grounds presented similar variations, the proportional numbers of plaice and dabs and other flat fish varying with the station.

The bottom at each of the trawling stations is of sand. It is already known from the results of experiments on grounds of different character that the nature of the fish fauna varies with the depth and the formation of the bottom, and it is now evident that the surrounding ground also exerts a considerable influence, at all events, on areas near the coast.

5.—Limitations of First Haul Experiment.

When all the experiments are taken together each year it is clear that the evidence of the first haul does not differ widely from that of the complete experiment. They point to a general fluctuation about a mean such as has also been shown to take place during the same period by the complete experiment. Taken separately, however, the results obtained by the short experiment do not agree in many instances with the longer experiment, and this is true even if attention be directed merely to the marketable fish. I have already dwelt upon the discrepancies between the two kinds of experiment in the report for 1901, and have there shown that while a short experiment of an hour or two indicates accurately enough the proportional numbers of fish on the ground, it is not to be trusted to give more than an approximation to annual fluctuations on an area liable to variation from such causes as have been mentioned above. This is again evident from a comparison of the two classes of diagrams in Chart 2.

Attention must be drawn, however, to the change with regard to the relative proportions of plaice and dab amongst flat fish, shown in Table X. and in Chart 1. Nothing can be gathered from the fluctuations from year to year of the marketable fish, but in the case of the first haul, since 1899, there is evidence of a striking dissimilarity in the proportions of the two forms, which further investigation may prove to be significant.

Notes on the Fish Fauna in General.

Flounders occur in relatively small numbers at all the stations except Alnmouth Bay where they are more numerous. These with the plaice and dabs are generally distributed in the bays, the turbot affect the part nearer the shore as a rule in company with plaice, and the soles occur most usually at the ends of the bays near the docks. One or two small lemon dabs have been caught on several occasions.

The fish other than flat fish are, with the exception of gurnards, not so constant in their occurrence during the months when the experiments are made, and in one or two instances present remarkable variations to which reference may now be made.

During the earlier years of the experimental period the hauls were characterised by the presence of large numbers of dog fish, *Acanthias vulgaris*. Since about 1898 not one specimen of this form has been seen at the experiments. On the other hand, the angler, *Lophius piscatorius*, has become more numerous, although this latter form has not been got constantly in these inshore regions at the experiments. The dogfish and the anglers are all immature examples. Skate, that is to say, thornbacks, *Raia clavata*, are procured in small numbers every year.

Other species which are obtained now and again are the lesser weever, *Trachinus vipera*, and more rarely the greater weever, *Trachinus draco*, the armed bullhead, *Agonus cataphractus*, and the lumpsucker, *Cyclopterus lumpus* (small examples).

The gurnards caught by the trawl and the line at the experiments range from small immature to mature, and are all common or grey gurnards, *Trigla gurnardus*. In 1902, however, in Blyth Bay, there were caught 5 sapphirine gurnards, and only one of the common species, and in the following year, again in Blyth Bay, one sapphirine gurnard was caught, which from its size appeared to have been a survivor of those which had accidentally visited the bay in the previous year.

Gadoids are apparently not common in the regions trawled in, codling, haddocks, whiting only being rarely caught. They seem to have been more common in the earlier part of the period. Shoals of small whiting visit the bays during the summer (*c.* section on food.) Occasionally cole-fish and lythe are procured.

II.—FOOD OF FISH CAUGHT AT THE TRAWLING EXPERIMENTS.

The observations on the food, etc., of the fishes, made in 1905, are given in Table XII.

A similar record has been kept each year since 1896, and the results for the whole period are presented in table XIII. In the latter table it will be seen that in certain cases the occurrence of the food is expressed by '*'. This is because the records for 1897, and for several other years were destroyed by the fire at the laboratory, and I have had to be content with the reports which have been printed.

Although the diet of the fish in the inshore waters of Northumberland is variable in its nature, the results, as a whole, show that that of plaice is essentially a molluscan one; that of the dab and of the thornback, crustacean; and that of soles, turbot, and brill, fish. The flounder is not so constant, but confines its attention mainly to fish and mollusca; and gurnards similarly to fish and crustaceans.

The mollusca which are most frequently used are *Donax trunculus* and *Tellina tenuis*, and the common crustacean is *Portunus holsatus*. The percentage occurrence of these and sandeels in all the fish examined is given in the following table:—

	1896	1898	1899	1900	1901	1902	1903	1904	1905
Sandeel . .	26	33	19	5	10	37	27	56	9
Donax trunculus .	46	3	3	4	2	1	7	2	2
Tellina tenuis .	14	11	14	8	11	13	7	4	5
Portunus holsatus .	32	10	8	4	18	14	12	8	6
Empty . . .	58	34	23	30	42	80	63	47	53

It is interesting to note that in the later years, in 1904 especially sandeels had taken an important place in the diet of the fish. It is a fact, moreover, that during these latter years *Portunus holsatus* which forms the chief food of the dab, and contributes largely to that of the thornback and the gurnard, has not been so conspicuous in the trawl. The same could be said to be true of *Donax trunculus* which with *Tellina tenuis* was the principal food of plaice at the beginning of the decade. It is obvious that the common forms of

food present in these bays are subject to considerable thinning from the fish which prey upon them, and it is tempting to attribute the diminution of the one to the increase in numbers of the other It is difficult, otherwise, to account for the changes which have taken place in the food during these years, when that is confirmed by observation upon the actual degree of occurrence of the forms in question.

In 1902-3 when the fish fauna reached its maximum according to our experimental results, a large percentage of the fish examined were recorded as empty.

In 1900, when I published a paper on the Mysidæ of Cullercoats (Report for that year, p. 72), I recorded a female *Schistomysis spiritus* from Cambois Bay. This year, as will be seen from the above table, a gurnard had swallowed a pure sample of some 40 examples of this species in Ahmouth Bay, young and adult of both sexes.

For some years Mr. Dent has kept general note of the food of the sea trout he captured at Blyth, and sandeels have been found to be the chief food. Last year he kept more careful note of the food, and the results of his examinations are recorded in the accompanying table.

SALMON TROUT EXAMINED AT BLYTH, 1905, BY MR. DENT.

Date.	No.	Weight—Lbs.	Food.
May 30	3	5, 5, and $3\frac{1}{4}$	Sand eels in each.
June 5	2	4, $3\frac{1}{2}$	do.
,, 15	2	$4\frac{1}{4}$, 1	One empty, the other Sand Eels.
,, 19	2	5, $3\frac{1}{4}$	Sand eels in each.
,, 26	3	4, 4, and $3\frac{1}{2}$	do.
,, 30	1	$3\frac{1}{2}$	Empty.
July 3	3	6, $5\frac{1}{4}$, and 3	All do.
,, 5	1	$3\frac{3}{4}$	Empty.
,, 7	2	4, $4\frac{1}{2}$	do.
,, 11	1	$3\frac{3}{4}$	Herring, juv.; Sprats.
,, 13	1	$3\frac{1}{2}$	Empty.
,, 18	1	3	do.
,, 20	1	$4\frac{1}{4}$	do.
,, 24	1	4	do.
,, 31	1	3	do.
Aug. 9	1	$3\frac{1}{4}$	do.
,, 11	1	$15\frac{1}{4}$	do.
,, 14	1	$3\frac{1}{4}$	do.
,, 28	1	3	do.

TABLE XII.—PLAICE.

The Food, Sex, and Maturity of fish caught at the trawling experiments in 1905.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remar
	Cm.	Oz.			Cm.		
June 30th ...	39 × 23	24	F.	—	6	Four Whitings (small) ...	.....
(Cambois)	34 × 20	14	M.	—	1·5	Empty	.....
	31 × 18	11	F.	—	2·5	,, ...	.....
July 12th ...	38 × 22·5	24	M.	—	2	*Tellina tenuis*	.....
(Alnmouth)	36 × 21	20	M.	—	1·5	Empty	.....
	30¼ × 19	12	M.	—	1	Nereis	.....
July 19th ...	42·2 × 23	32	F.	Mature	7	Sand eels	.....
(Druridge)	40 × 22·5	23	F.	—	4·7	Empty	.....
	31 × 17·5	8	F.	—	3·5	,, ...	.....
July 26th ...	41 × 24	23	F.	—	10	Empty	.....
(Blyth)	33 × 20·5	14	F.	—	3¼	,, ...	.....
	28·2 × 17·8	8	M.	—	1	,, ...	.....
Aug. 2nd ...	36·5 × 24·5	24	M.	—	2	Sand eels	.....
(Druridge)	36·5 × 21·5	19	M.	—	2	,, ...	.....
	32·2 × 20·2	15·5	F.	—	3·5	Empty	.....
Aug. 16th ...	33·5 × 20	14	M.	—	1·2	*Tellina tenuis*	.....
(Alnmouth)	35 × 22·5	18	M.	—	2	,, ...	.....
	32·3 × 19·5	13	M.	—	1·2	Empty	.....
Aug. 23rd ...	39 × 25	26?	F.	Mature	5	*Donax trunculus*	Weighing
(Cambois)	28·5 × 18	9?	M.	—	1¼	*Tellina tenuis*	,, d
	25·7 × 15	9?	M.	—	1	,, ...	,,

Table XII. Continued.—DAB.

and e.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	Cm.	Oz.			Cm.		
th ...	29·5 × 16	11	F.	—	3	Empty	.....
bois)	27 × 14	8	F.	—	4	,, ...	.....
	22 × 11	6	F.	—	2	,, ...	.....
h ...	27·5 × 16	9	F.	—	2½	Empty	.....
outh)	26 × 14·5	7	F.	—	4	Solen? (small part of foot)	.....
	22·7 × 12·5	6	F.	—	2	Empty	.....
h ...	36·5 × 21	16	F.	Mature	8·2	Empty	.....
idge)	31·5 × 17·5	12	F.	—	4·5	,, ...	.....
	27·5 × 15	6	F.	—	5	Weed with amphipods ...	.....
h ...	26 × 13·5	6	F.	—	2·2	Herring (young)	.....
dyth)	20·8 × 12·8	4	F.	—	3·5	Empty	.....
	22 × 12	4?	F.	—	3·8	,, ...	.....
d ...	36 × 19·8	15	F.	Mature	10	Empty	Spawned
idge)	31·8 × 19·5	12	F.	—	5	*Donax trunculus*	.....
						P. holsatus	
	25·8 × 14	5·5	F.	—	3·5	Amphipods—	
						Paratylus swammerdami	.....
						Gammarus marinus	.....
th ...	28 × 15·5	8	F.	—	4·2	Empty	.....
outh)	27·8 × 15·7	8	F.	—	4	*Corystes cassivelaunus* ...	.....
	21 × 11	3·5	F.	—	2·5	Empty	.....
rd ...	35·5 × 19·5	16?	F.	—	6·2	*P. holsatus*	Weight uncrtn.
bois)	31 × 17·5	12?	F.	—	4·5	,, ...	.....
	27 × 14·2	9?	F.	—	3·7	,, ...	.....

Table XII. Continued.—TURBOT.

Date and Place.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remar
	Cm.	Oz.			Cm.		
June 30th ...	47×38	84	F.	Mature	10	Empty	.....
(Cambois)	34×27	36	F.	—	3	,, ...	.....
July 12th ...	43×32½	60	F.	—	8½	Empty	.....
(Alnmouth)	37×29	36	F.	—	5	,, ...	.....
	33½×26½	32	M.	—	3	,, ...	.....
July 19th ...	32×25	24	M.	—	2	One sand eel	.....
(Druridge)	35·5×28	34	F.	—	5·5	Empty	.....
	31×25·5	23	F.	—	4·5	Two sand eels	.....
July 26th ...	34·5×26·5	27	M.	—	3	Empty	.....
(Blyth)							
Aug. 2nd ...	38·8×31·3	44	F.	—	7	Weever? much digested	.....
(Druridge)	38·5×31	42	F.	—	5·8	Empty	.....
	34·5×27·5	30	M.	—	2·5	,, ...	.....
Aug. 16th ...	41·7×33·7	59	F.	—	5·3	Small gurnard	.....
(Alnmouth)	34·7×26·5	31	F.	—	3·7	Empty	.....
	35×27	28	M.	Mature	4	Herring (16 cm.)... ...	.....
Aug. 23rd ...	37·2×29·5	35?	M.	Mature	3·2	Empty	.....
(Cambois)	31×25	20?	F.	—	4·7	,, ...	.....

THORNBACK.

June 30th ... (Cambois)	44×33	24	F.	—	...	*P. holsatus*	.....

COD.

July 19th ... (Druridge)	44·2	39	M.	Immature	...	Empty	.....

BRILL.

y 19th ... ruridge)	42×28	41	M.	Mature	3·5	One sand eel	.....

Table XII. Continued.—SOLE

and ce.	Size.	Weight.	Sex.	Mature or Immature.	Size of Gen. Organ.	Food.	Remarks.
	Cm.	Oz.			Cm.		
)th ...	34×15	14	F.	—	12	Empty	.....
nbois)	37·2×15·5	15	F.	—	12	,, ...	.....
	32·5×14	13	F.	—	10	,, ...	.....
3th ...	44×20	28	F.	Mature	19	Empty	.....
outh)	38×16·5	20	F.	,,	19	,, ...	.....
	32·5×14·5	14	F.	,,	17	,, ...	.....
)th ...	37·5×16·2	19	M.	—	1·5	Empty	.....
ridge)	32·7×14·2	12	F.	—	12·5	,, ...	.....
	31·7×14	10	F.	Mature	5·75	,, ...	.....
5th ...	47·5×21·5	32	F.	Mature	21·5	Nereis	.....
Blyth)	40·2×17·3	21	F.	,,	18·5	Empty	.....
	33·2×14	12	F.	,,	15	,, ...	.....
nd ...	45·5×21·5	32	F.	Mature	19	Empty	.....
ridge)	36×16·5	17·5	F.	,,	18	,, ...	.....
	32·5×14	10	M.	—	1	,, ...	.....
5th ...	36×15	15	M.	—	1·2	Empty	.....
outh)	35×14·5	14	F.	Mature	14·5	,, ...	.....
	30·2×13·5	10	M.	—	1·7	,, ...	.....
3rd ...	36×16·7	16?	F.	—	11·5	Empty	.....
nbois)	34·5×15	14?	F.	Mature	12·5	Nereis	.....
	29·7×13·7	9?	F.	,,	10·0	Empty	.....

GURNARD.

)th ...	37·5	...	F.	Mature	...	Sand eel	.....
ridge)	29·7	...	F.	,,	...	Empty	.....
	39	18	F.	,,	...	*P. holsatus*	.....
5th ...	36·2	16	F.	Mature	...	One sand eel (large) ...	.....
Blyth)	34·8	14	F.	,,	...	Sand eels (small)... ...	.....
	28·8	6	F.	,,	...	Empty	.....
nd ...	39	16	F.	Mature	...	Empty	.....
ridge)	37·5	13	F.	,,	...	Sand eel	.....
5th ...	33	10	F.	Mature	...	Empty	.....
outh)	30·5	8	F.	,,	...	,, ...	.....
	30·5	9	F.	,,	...	*Schistomysis spiritus* ...	.....

TABLE XIII.—Food of Fish caught at trawling experiments.

PLAICE.

	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	Totals.	
Number	33	x	29	23	21	28	27	27	24	21	233+x	
Sand eel	1	...	6	6	...	...	4	4	12	3	36	Fis
Weever	1	...	...	...	...	1	...	...	...	...	2	
Whiting	...	...	...	...	...	.	...	...	...	1	1	
D. trunculus	26	xx	3	2	5	2	1	6	3	1	49+x	Mo
T. tenuis...	7	xx	8	13	6	8	9	6	1	5	63+x	
Solen	...	1	...	...	4	1	1	1	...	...	8	
V. gallina	2	...	...	...	...	...	...	...	...	...	2	12
Mytilus jv.	...	...	1	...	...	...	...	..	...	..	1	
Moll. incert.	...	.	..	...	...	2	...	1	...	...	3	
Annelid	1	1	3	2	4	4	4	4	...	1	24	Wo
Nemertean	...	...	...	...	1	.	...	...	...	...	1	
Amphipod	...	1	...	...	1	2	...	...	..	...	4	Cru
Empty	3	...	9	2	4	11	11	8	9	10	67	

DAB.

Number	28	x	29	17	19	24	27	24	24	21	213+x	
Sand eel	...	...	9	2	...	1	1	1	10	...	24	Fish
Fish ova	...	...	...	...	...	...	1	...	...	...	1	
Herring	...	...	...	...	...	...	...	...	...	1	1	
P. holsatus	16	xx	9	7	4	10	6	7	7	4	70+x	
Corystes cassivelaunus...	...	...	...	...	..	...	...	...	...	1	1	Cru
Eupagurus	1	...	4	...	...	...	...	...	...	...	5	91
Amphipod	...	...	1	5	4	1	...	...	1	2	14	
Idotea balthica	...	1	...	...	...	...	...	...	...	...	1	
Mactra	3	...	...	...	...	...	...	...	...	...	3	
Mytilus	1	...	1	...	...	...	...	...	...	...	2	
Nassa	1	...	...		...	...	..	...	...	.	1	
Solen	2	x	...	...	...	4	7	4	...	1	18+x	Mol a
D. trunculus	1	...	...	1	...	...	...	...	...	1	3	38
T. tenuis...	...	...	2	1	3	..	...	...	...	...	6	
Moll. incert.	1	...	..	2	...	...	...	1	...	...	4	
Anomia	...	...	...	...		1	...	...	...	...	1	
Annelid	...	x	...	...	...	...	...	...	...	...	x	Wor
Ophiura albida	...	...	...	...	...	2	...	...	...	...	2	Ech
Alga	...	...	...	...	...		1	..	...	...	1	Alga
Empty	5	...	5	1	6	6	11	11	6	11	62	

SOLE.

Number	29	x	7	14	19	15	25	22	25	21	177+x	
Sand eel	7	x	1	4	...	2	5	3	6	...	28+x	Fi
Dab	...	...	...	...	...	...	..	...	1	...	1	31
Fish incert.	1	...	...	...	1	...	...	...	.	...	2	
Annelid	1	x	...	3	2	4	...	2	2	2	16+x	Wo 16
Shrimp	1	...	...	...	...	...	...	...	.	...	1	Crus
Empty	20	...	6	8	16	10	20	17	16	19	132	

TABLE XIII.—CONTINUED.—TURBOT.

	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	Totals.	
nber	22	x	19	12	13	14	14	22	16	17	149+x	
l	5	xx	7	4	5	4	9	5	8	2	19+x	Fish 99+x
... ...	5	.	3	3	...	..	...	...	2	1	14	
;	11	xx	1	...	1	1		3	4	...	24+x	
... ...	...		...	...	...	...	...	2	...	...	2	
l	...	...	..	...	...	...	...	.	...	1	1	
cataphractus ...	...	...	...	...	...	...	...	1	...	...	1	
... ...	...	..	..	3	...	...	2	..	...	1	6	
ert.	..	...	...	...	...		...	2	...	...	2	
... ...	...	1	...	...	...	1	...	...	...	..	2	Worm 2
tus	..	...	...	...	..	1	...	...	...		1	Crust. 1
... ...	4	..	7	3	7	7	5	9	4	12	58	

BRILL.

mber	2	...	9	3	2	3	2	5	2	1	29	
l	...	...	6	3	1	1	1	2	1	1	16	Fish 22
;	2	...	2	...	...	..	...	...	...	...	4	
... ...	..	...	...	...	...	...	1		...	...	1	
... ...	...	...	...	...	...	...	..	1		..	1	
... ...	...	...	..	..	...	1	...	...		...	1	Crust 1.
... ...	...	...	1	...	...	1	...	2	1	..	5	

FLOUNDER.

mber	8	x	11	5	2	3	9	...	13	.	51+x	
l	2	.	2	1	...	..	..	...	8	...	13	Fish 15
;	...	...	1	..	...	...	...	...	1	...	2	
is	3	xx	1	1	..	2	1	...	2	...	10+x	Mollusca 19+x
culus	5	...	...	...	.			...	...	..	5	
orum	1	...	...	...	...	...	...	...	..	...	1	
jv.	1	...	1	...	...	..	..	...	..	...	2	
... ...	...	...	1	...		...	...	...	...	..	1	
... ...	...	...		...	1	...	...	...	...	...	1	Worm 1
tus	1	...	1	...		...	1	...	...	...	3	Crust. 6
od	...	3	.		...	...	...	...	...	...	3	
... ...	...	...	5	3	1	1	7	...	3	...	20	

TABLE XIII.—CONTINUED.—GURNARD.

	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	Totals.	
Number	17	x	...	13	9	11	18	19	10	11	108+x	
Sand eel	3	x	...	3	...	2	12	8	5	4	37+x	F 47
Whiting	1	...	...	...	...	...	...	1	1	..	3	
Dab	...	...	...	...	1	...	..	...	...	...	1	
Herring	...	...	...	...	...	..	1	...	...	...	1	
Fish incert.	1	...	...	1	2	..	...	1	...	...	5	
P. holsatus	4	x		2	1	3	4	3	.	1	18+x	Cru 34
Shrimp	2	x	...	4	3	1	2	1	2	...	15+x	
Idotea balthica	...	...	...	...	...	1	...	...	...	...	1	
M. stultorum	1	...	...	...	...	...	...	...	...	...	1	
Loligo	1	...	...	...	...	...	...	...	...	...	1	Moll
T. tenuis...	...	...	...	...	...	1	...	..	...	...	1	
Annelid	...	...	...	..	..	...	...	1	...	...	1	Wo
Empty	6	...	...	5	2	5	3	6	2	5	34	

ANGLER.

Number	4	x	...	7	...	1	10	x	x	x	28+x	
Weever	2	x	...	3	...	...	2	x	...	...	7+x	
Dab	...	1	...	1	...	...	2	x	x	...	4+x	
Plaice	...	1	...	...	...	...	2	x	...	...	3+x	
Whiting	...	...	...	...	...	1	1	x	x	x	2+x	F 19
Sand eel	...	...	...	...	...	...	x	x	x	...	x	
Haddock	...	...	...	...	...	...	1	...	...	...	1	
Gurnard	...	...	...	...	...	...	1	...	...	...	1	
Fish incert.	...	...	...	...	...	...	1	...	...	...	1	
Empty	2	...	...	3	...	...	4	...	...	...	9+x	

THORNBACK.

Number	1	3	x	...	...	4	...	...	...	1	9+x	
Sand eel	...	...	1	...	. .	...	...	...	...	...	1	Fish
P. holsatus	1	3	x	...	...	4	...	...	...	1	9+x	Cru
Shrimp	...	...	...	...	...	1	...	...	...	...	1	10
Solen	...	...	1	...	...	...	...	...	...	...	1	Moll

MACKEREL.

Number	...	...	...	2	...	...	1	...	...	...	3	
Herring	...	...	...	2	...	...	...	...	...	...	2	Fish
Sand eel	...	...	...	...	...	...	1	...	...	...	1	

HADDOCK.

Number	...	...	...	...	...	...	1	...	...	...	...	
Sand eel	...	...	...	...	...	...	1	...	...	...	...	Fish

COD.

Number	...	x	...	...	...	...	1	1	...	1	3+x	
Dab	...	1	...	...	...	...	...	...	...	...	...	
Sand eel	...	x	...	...	...	...	1	...	...	...	...	Fish
Gurnard	...	...	...	...	...	...	...	1	...	...	...	
Shrimp	...	...	...	...	...	...	1	...	...	...	...	Crus
Ed. Crab...	...	...	...	...	...	...	...	1	...	...	...	
Empty	...	...	...	...	...	...	...	...	...	1	...	

III.—MIGRATIONS OF INSHORE FLAT FISH.

In the report for last year I gave an account of the results of the experiments which had been made in connexion with the trawling experiments to determine the migrations of the inshore flat fish of the Northumberland district.

The visits of the Stanley to the various trawling stations in 1905 gave the opportunity for marking a number, principally dabs, in the earlier part of the season with the remainder of the labels we had procured in the previous year, and latterly with labels kindly supplied by Mr. Garstang of the Lowestoft Laboratory.

1905.		Dab.	Flounder.	Sole.	Turbot.	Cat Fish.	Total.
June 30	Cambois ...	31	3	...	...	...	34
July 12	Almouth ...	37	2	2	...	...	41
,, 19	Druridge ...	43	7	...	10	...	60
,, 26	Blyth ..	77	15	1	3	...	96
Aug. 2	Druridge ...	29	1	...	15	1	46
,, 7	Skate Roads	1	2	...	6	...	9
,, 16	Almouth ...	29	12	...	1	...	42
,, 23	Cambois ...	11	...	...	...	...	11
,, 23	Blyth ...	27	...	...	...	...	27
Sep. 6	Druridge ..	4	...	1	1	...	6
		289	42	4	36	1	372

The total number of fish which have thus been marked and liberated in the Northumberland district are shown in the following table:—

	Plaice.	Dab	Flounder.	Sole.	Turbot.	Cat Fish.	Total.
1903 ...	470	9	...	1	1	...	481
1904 ...	7	432	25	...	4	...	468
1905 ...	...	289	42	4	36	1	372
	477	730	67	5	41	1	1321

In addition to those which were recaptured in 1904, referring to the experiments of that and the previous year (v. rep. for 1904), a number have since been obtained, and are included in the following table which completes the returns to February, 1906.

Plaice.—None of the plaice marked in 1904 has been recovered (unless the one recorded last belongs to that group), but the records in Table XIV. bring the number recaptured of the 470 plaice liberated in 1903 to 70:—7 in 1903, 55 in 1904, and 8 in 1905. The latter are interesting since the fish have been free for long periods, have made conspicuous increments in growth, and have in the majority of cases migrated to great distances.

The plaice sent from London market (1904), Grimsby market, and Aberdeen market must be included amongst those which have left our district although it is unfortunately impossible to tell where they were caught or in what direction they had migrated. In the case of No. 873, the information which was furnished enabled me to make an attempt to discover the history of the fish, and it can be said that it is more than probable that the fish was captured in the Moray Firth. It was sent to the Lowestoft Laboratory from Manchester wholesale fish market, with a note that it was found in a barrel from Nairn, Scotland. I wrote to Dr. T. W. Fulton with regard to the capture, and his reply was "The fishery officer reports that the marked fish you referred to must have been caught between Burghead and Nairn, at no great distance off, as the Nairn fishermen usually fish for plaice in that locality."

Of the nine which are recorded in the table (or to be more certain of the eight—it is possible that the last one, the numbered label of which was wanting, belonged to the 1904 group, as its size indeed suggests) three have not migrated. These show also that the size about which migration may take place is from 29 to 35 cm. or $11\frac{1}{2}$ to 12 in. All the Northumberland marked fish above 35 cm. have migrated from the district; below that size they exhibit on the whole no tendency to migrate except within the bays, and only rarely move for short distances up or down the coast. The trawling experiments have also demonstrated that plaice, and dabs, as well, migrate outwards and inwards in territorial waters. The immigrants to the region so near the shore as the trawling stations are usually derived from the slightly deeper water immediately outside, but they include occasionally representatives from extra-territorial waters. These latter give reason for saying that there is in the summer, and at other seasons also, a general inshore movement affecting the fish fauna of the regions outside the district as well as that within it, followed by an outward migration—a general advance and retreat.

Our experiments show also that when the migratory impulse does come it may carry the fish very many miles from the Northumberland coast, and although it cannot be said to be universal, the direction of migration is usually northerly.

Dab.—It will be seen from the above returns that a large number of dabs have been marked, principally during the last two years. Of the 9 marked in 1903, one was recaptured, a female of 21·6 cm.,

which had migrated about a mile to the east, from Almouth Bay to the north of Coquet Island. Sixteen of the 432 liberated in 1904 were recovered the same year, the only conspicuous migrations being in the case of two males measuring respectively 21 and 18·5 cm., to the south and east, and into extra-territorial water. Another showed a similar movement, but the label was not returned, and the sex was not stated. The females recaptured had not migrated, or but a short distance south or east. In 1905, other two, females, were obtained, one which had grown from 20·5 to 25 cm., and was caught where it was liberated; the other had grown from 20 to 27 cm. and had migrated 22 miles to the south, from Skate Roads to Druridge Bay. Of the 1905 group, 10 have already been accounted for, two females which had migrated in one case 60 miles and in the other 40 miles to the south and east. The others had not migrated or only a short distance to the south.

Thus 29 have been recaptured out of 730 so far as we have knowledge. Both sexes are liable to migrate to the south, within or from our district. Six of the 29 have shown this tendency. It cannot be said that size regulates the migration, for larger examples than those which left the bays had evidently chosen to remain where they were. Moreover, while the migration appears to take place about the end of the year, the movement is not a general one, for examples are caught during that season which had not migrated, including fish of the same, of a less, and of a larger size.

The direction of migration is, or appears to be definitely a southerly one. It may be considered advisable, however, not to attempt an explanation of this until we find if some of the large number which have been marked will be recovered after a longer period of freedom than that illustrated by the examples which have so far been reported.

Flounders.—Two of the 1904, and ten of the 1905 groups have been recaptured, or 12 out of 67. The majority were caught shortly after they were liberated, but three were free for 59, 81, and 160 days respectively. None showed any tendency to migrate, except in a few cases a short distance to the south.

Turbot.—Only two of the 41 turbot which have been marked have been recovered, both belonging to the 1905 group. One, a male, had grown from 29·8 to 32·8, and had migrated from Druridge Bay to 4 miles E.S.E. of the Coquet. The other, a female, was caught where it was liberated, after an interval of 38 days, in Skate Roads.

Table XIV.—PLAICE. (+ = Mature, — = Immature.)

Number	Date.	Length.	Where Liberated.	Where Captured.	Date.	Length.	Increase.	Sex.	Migration.
	1903.	Cm.			1905	Cm.	Cm.		
803	June 26	27·3	Goswick Bay ...	Sent from Grimsby Market	Feb. 6	39·9	12·6 in 590 days	m+	?
858	July 15	32·7	Druridge Bay ...	Sent from Aberdeen Market	1904. Dec. 17	44·2	11·5 in 520 ,,	?	?
864	,,	20·6	,, ...	28 miles E. by N. of Tyne	1905. Jan. 12	29·6	9 in 547 ,,	f	29 miles E.S.E.
873	,,	18·4	,, ...	Moray Firth (see text) ...	Mar. 30	34·2	15·2 in 624 ,,	f—	220 ,, north
919	July 23	24·1	Blyth Bay	Blyth Harbour	Mar. 11	32·4	8·3 in 597 ,,	f—	1 ,, north
967	Aug. 4	19·7	Skate Roads ...	Skate Roads	Mar. 20	32·1	12·4 in 594 ,,	f—	o
993	,,	24·1	,, ...	30-40 miles E.N.E. of May Isle	ca. Nov. 15	41·5	17·4 in 1034 ,,	m	60 miles north
122	Aug. 26	21·6	Cambois Bay ...	Cambois Bay	Mar. 8	34·3	12·7 in 569 ,,	f—	o
?	?	?	?	,, ...	Feb. 19	25·3	?	m	?

DAB.

	1904.				1905.	Cm.	Cm.		
369	July 6	20·5	Druridge Bay ...	Druridge Bay	Nov. 18	25·0?	4·5 in 489 days	f –	o
541	Aug. 1	20·0	Skate Roads ..	,, ...	Oct 9	27·0	7·0 in 434 ,,	f–	22 miles south
	1905.				1905.				
803	June 30	?	Cambois Bay ..	Cambois Bay	July 24	?	? in 24 ,,	?	o
826	,,	22·0	,, ...	,, ...	Sep. 18	?	? in 80 ,,	f—	o
922	July 26	18·0	Blyth Bay	Seaton Sluice	Aug. 17	18·0	o in 23 ,,	f—	½ mile south
967	,,	19·0	,, ...	Blyth Bay	Aug. 11	19·0	o in 16 ,,	m—	o
969	,,	23·5	,, ...	Scarborough, South Bay, 4 fathoms	1906. Jan. 8	25·6	2·1 in 166 ,,	f +	60 miles S.E.
					1905.				o
988	,,	18·0	,, ...	Blyth Bay	Aug. 10	18·0	o in 15 ,,	f—	
1328	,,	20·0	,, ...	Seaton Sluice	Aug. 25	?	? in 30 ,,	f—	½ mile south
1331	,,	20·5	,, ...	Blyth Bay	Aug. 23	21·0	0·5 in 28 ,,	f—	o (released again)
1360	Aug. 2	23·0	Druridge Bay ..	Druridge Bay	Sept. 20	23·0	o in 49 ,,	m–	o
1466	Aug. 23	19·0	Blyth Bay	Whitby (fine), found in 35 fathoms	1906. Feb. 7	19·0	o in 168 ,,	f—	40 miles S.E.

Table XIV. Continued.—FLOUNDER.

Number	Date.	Length.	Where Liberated.	Where Captured.	Date.	Length.	Increase.	Sex.	Migration.
	1904.				1904,	Cm.	Cm.		
420	July 13	23·0	Almouth Bay ...	Almouth Bay	Dec.	?	? in ca 160 days	f	o
434	,,	19·5	,, ..	1 mile south of Amble Harbour	Sep. 10	20·2	0·7 in 59 days	m	1½ miles south
	1905.				1905.				
904	July 19	26·5	Druridge Bay ...	Druridge Bay	Oct. 11	27·2	0·7 in 84 ,,	m	o
?	?	?	? ...	,, ...	,,	?	?	?	? (no label)
927	July 26	25·2	Blyth Bay	Blyth Bay	Aug. 10	25·2	0 in 15 ,,	f—	o
928	,,	28·7	,, ...	,, ...	,,	28·8	0·1 in 15 ,,	m—	o
932	,,	24·0	,, ...	Hartley	Aug. 7	?	? in 12 ,,	?	½ mile S. (label only)
933	,,	24·0	,, ...	Blyth Bay	Aug. 15	24·0	0 in 20 ,,	m—	o
936	,,	20·5	,, ...	,, ...	July 28	?	? in 2 ,,	?	o (label only)
991	,,	22·5	,, ...	Hartley	Aug. 17	23·5	0 in 22 ,,	f—	½ mile south
1380	Aug. 2	21·0	Druridge Bay ...	Druridge Bay	Aug. 9	21·0	0 in 7 ,,	f—	o
1412	Aug. 16	31·2	Almouth Bay ..	Almouth Bay	Aug 26	?	? in 10 ,,	f—	o

TURBOT.

	1905.				1905.				
1354	Aug. 2	29·8	Druridge Bay ...	4 miles E.S.E. of Coquet in 28 fathoms	Dec. 7	32·8	3 in 127 days	m	4 miles E. ½ N.
1388	Aug. 7	28·4	Skate Roads ...	Skate Roads	Sep. 14	30·5 ?	2·1 ? in 38 ,,	f	o

IV.—GROWTH OF THE FLAT FISH.

Relation of breadth and weight to length.—In the report for 1903, p. 40, I gave a chart which showed approximately the average relationship of breadth and weight to length in plaice. It was found that the breadth when plotted out formed a straight line of 30° slope, and it was concluded therefore that the average relation of breadth to length was ·58 to 1. The weight was shown similarly to form a curve of the form, $w=kl^3$, or $w=k\,(bl)^{\frac{3}{2}}$* The measurements made at the trawling experiments, and in connexion with the marking of the fish, have furnished the materials for constructing similar charts for the dab, flounder, sole, and turbot. (Chart 4.)

The breadth of the dab when mapped out in relation to the length is also approximately a straight line of ·55 to 1. The weight forms a curve like that given for the plaice,—there is much variation, but some of it at least is due to the difficulties in weighing on board the steamer.

The breadth of the flounder is found to bear a relationship to the length of ·57 to 1, and the weight forms a curve which expresses the average relation to length.

The breadth of the sole approximates to ·44 of the length, and the weight clearly bears a similar relationship to the length to that shown in the preceeding examples.

The line of breadth of the turbot is interesting because it is more clearly a straight one than in the other forms, and is related to the length as ·77 to 1. The curve of weight in relation to the length in this case has been analysed in the manner described in the paper on the plaice referred to above, and although it does not form a straight line it is nearly a straight line, so that the weight is approximately $= kl^3$, where $k = ·125$.

In all these cases, the measurements and weights, with few exceptions, were made on living examples.

Growth of Plaice.—The average determination of weight in relation to length is useful in an attempt to state the rate of growth; and in the report for 1904, I was able by means of the chart already published to state approximately the yearly growth in weight of plaice. I had not then the time to give in detail the figures from which the conclusions were drawn, but as a matter of fact they had

* See also Chart IX in the paper on the Growth of *Carcinus mœnas* in the report for 1902.

ppeared in the preceding reports in the tables giving the measurements of the first haul, and the results of the migration experiment ive the additional information necessary for making an attempt to ate the rate of growth of this species. It has not been possible to ake an anatomical investigation of the material for that purpose.

The method I have employed is based upon the results of the apers I have published on the growth of mammals, on material r stating the growth in other groups not yet published, and those lating to the crab (Reports for 1902 and 1904).

Since His first stated the fact in relation to the chick in 1868, searches on the growth of organisms, of organs and tissues have emonstrated the universality of the law that the rate of growth radually declines from the beginning, and also that the curve of rowth in all cases is a similar one, viz., at first gradually rising om the horizontal, then more rapidly with increase of bulk, bending again gradually to the horizontal with the approach of the period f attainment of the maximum size. It is, in fact, such a curve as nat given for the plaice and for the shore and the edible crabs in revious reports. It is not meant that every animal reaches its xtreme size by a gradual expansion along such a curve as I ave described. The individual curves are liable to considerable uctuations above and below, and periods of stasis or even of retreat ay intervene, though the latter is exceptional. But what I do ean is, that, if a sufficient number of examples be taken, the verage or normal result will be a curve of that shape.

To turn now to the material from which, bearing these facts in ind, the rate of growth has been determined. The analysis of the rst haul shows that in the early part of the summer, there are laice on the Northumberland coast from 4 to 6 in. in length in rge numbers, pointing distinctly to a stage with an average size of in., as the accompanying tables illustrative of the large series have constructed indicate. Later in the summer the inshore igration of slightly larger plaice tends to mask this group. In ome cases it stands out prominently, however, at about 7 in. 5 to 9 in.) Towards the end of the season, moreover, these mmigrants from the slightly deeper waters outside our trawling tations, group themselves about 9 to 10 in., and about 12 to 13 in. hese I took to be successive years of growth. The young shore tages, 1¼ to 1½ in. of June and July are already known. The points hus obtained were plotted out and connected by a curve of the shape

mentioned, and this was made the basis for marking out the increments of growth actually observed to have been made by the marked plaice in known periods of time. When the chart referred to was published* I had only the results in the case of fish which had been free for less than a year. It will therefore be worth while here to append a comparison between the calculated size from the chart and the actual growth of the fish which have been caught after a long period of liberation. (See page 56.)

Date of Liberation.	Date of Recapture.	Size		Difference.
		Calculated.	Actual.	
1803	1905	Cm.	Cm.	Cm.
June 26 ...	Feb. 6 ...	37·5	39·9	+ 2·4
	1904			
July 15 ...	Dec. 17 ...	42	44·2	+ 2·2
	1905			
,, 15 ...	Jan. 12 ...	32	29·6	— 2·6
,, 15 ...	Mar. 30 ...	32	34·2	+ 2·2
,, 23 ...	,, 11 ...	34	32·4	— 1·6
Aug. 4 ...	,, 20 ...	32·1	32·1	0
,, 4 ...	Nov. 15 ...	39	41·5	+ 2·5
,, 26 ...	Mar. 8 ...	33·5	34·3	+ 0·8

The three which come nearest to my estimate of the growth of the plaice are those which had not migrated, and with one exception the plaice which had left the district showed an enhanced rate of increase.

The age determination at which I arrived is one year in advance of other modern investigators. The different statements depend upon the existence or not of a group intervening between the 6 in. stage and the known shore stage. Both Fulton† and Wallace‡ confess to its being but slightly represented, and further facts with regard to it are still required.

The mesh of our trawl net is too large to demonstrate fully whether it is present in the Northumberland region or not, but at

* Trans. Newcastle Nat. Hist. Soc., 1904.
† Rep. Fish. Bd. for Scotland, for 1901.
‡ Rep. North Sea Fish. Invest. Com., No. 2.

ate Roads, Druridge Bay, and Blyth Bay its presence has been dicated several times. The recent investigations to the north d the south have shown that such a stage actually occurs, and it now obvious that the growth in this region must include it also. ie restatement of the average growth of the plaice in the Northnberland district may be said to be approximately:—1 year, cm.; 2 years, 13·5 cm.; 3 years, 22 cm.; 4 years, 28·5 cm.; 5 ars, 35 cm.; 6 years, 40 cm.; 7 years, 45 cm. The year is sumed to end on March 31st.

Growth of the Dab.—A consideration of the measurements of e first haul shows that early in the summer, June, July, there is group of 7 to 8 in. or about 19 cm. In August, September, stages 5 in. or 12·7 cm. and 9 to 10 in. or 21 cm. may be seen in some asons. But the larger groups, for reasons which have already been ated, are not so commonly present as in the case of plaice. These oints are taken in accordance with the method explained above, to present successive years' growth, and a trial curve joining them rms a basis upon which the actual growth of the marked fish may e mapped out. The growth of the dab during the first year is nown from the work of Cunningham, Williamson, and others, and is serves to give the origin and early trend of the curve. From ese results it is now possible to deduce the average growth of the ab to be that stated in the following table. The year is assumed begin on 1st June.

	Length.	Weight.
1 year	4 cm.	.03 oz.
2 years	11·5 ,, ...	·7 ,,
3 ,, ...	18·5 ,, ...	3·0 ,,
4 ,, ...	23·5 ,, ...	5·7 ,,
5 ,, ...	27·5 ,, ...	9·0 ,,
6 ,, ...	29·7 ,, ...	11·0 ,,

A dab which I had in the Cullercoats Laboratory, got at Skate oads on June 20th, some years ago, measured 2 in. (5 cm.) and eighed (after being preserved in formalin), 1·02 grains. (·035 oz.) It ust, therefore, have been just over one year old, and the weight of ie dab at one year may be taken to be ·03 oz. The weights for ie succeeding yearly stages are derived from the chart showing the lation of length to weight.

Growth of the Flounder.—Relatively few flounders are ught at the trawling experiments, but at Alnmouth Bay especially

sufficient have been obtained to show that in June, July, or even as late as August, they group themselves about 8 in., say 20 cm. These would appear to be just over three years old. The results from the marking of this species are practically of no use to indicate the rate of growth, although it may be said to be similar to, but less rapid than that of the plaice.

Growth of the Turbot.—So few turbot are obtained that it is impossible to state the rate of growth from captures by the trawl. One series, however, got in August, 1903, at Skate Roads, points to a stage of about 24 cm. When all the results are added together for the total number of years, hints at stages of about 9 and 11 in. begin to emerge, or say about 22·5 and 28 cm., and other stages of 32·5 and 36 cm. may be distinguished.

One of the turbot liberated on August 2, measuring 29·8 was free for 127 days, and during the period increased in length to 32·8 cm. Another, which I did not see, however, when it was captured, was said to have grown from 28·4 to 30·5 in 38 days. When plotted out the former at least lies on a line parallel to that joining the points above mentioned.

The growth during the first year is variously stated by the different observers, some showing it to be very rapid, and others to be slow. Two specimens which were in the Cullercoats laboratory, obtained in August, 1899, near the fish quay at North Shields, measured each $1\frac{5}{8}$ by $1\frac{5}{16}$ in. (length = 4·1 cm.) and weighed 1·38 and 1·52 grs. respectively. Another caught in December, measured $4\frac{1}{2}$ by $3\frac{1}{2}$ in. (length = 11·4 cm.), and weighed 20·9 grs. All three have already been used in giving points on Chart 4. If the turbot's life be assumed to begin on June 30th, it is difficult to think that both of these stages belong to the first year, and it is more than probable that the smaller have just entered upon the second year, and the larger is in the middle of that year. The general trend of growth in the turbot would thus appear to be:—1 year, ca. 5 cm.; 2 years, ca. 18 cm.; 3 years, ca. 27 cm.; 4 years, ca. 32·5 cm.; 5 years, ca. 37·5 cm.

PLAICE.

SKATE ROADS.														June.		
June.							Total.	August.					Total.	* D.	* A.	* S.
899.	1901.	1901.	1901.	1902.	1903.	1903.		1899.	1900.	1901.	1902.	1903		1900.	1900.	1901.
...	2	7	7	...	...	...	16	...	1	...	...	1	2	6	...	7
...	20	33	40	1	1	...	95	5	13	46	7	4	75	5	6	83
2	29	41	46	24	5	2	149	13	24	13	21	29	100	14	10	16
1	29	33	43	9	7	11	133	19	46	2	70	28	165	15	18	15
2	14	16	27	5	8	6	78	24	38	4	42	23	131	9	17	6
3	9	12	15	4	9	10	62	5	12	...	17	16	50	...	10	...
2	4	10	9	...	13	12	50	6	2	4	11	9	32	...	1	1
2	2	11	1	3	16	13	48	2	1	7	9	2	21	4	9	1
1	1	5	10	...	13	11	41	2	1	12	5	1	21	5	3	3
5	2	3	3	2	7	6	28	4	...	1	2	...	7	5	2	1
1	.	1	2	2	...	2	8	2	...	...	1	...	3	1	6	1
1	...	2	...	...	...	1	4	...	...	...	...	...	...	6	...	...
...	...	...	..	...	...	...	...	...	...	...	...	..	...	1	2	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
...	...	...	...	...	.	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	. .
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	..	..	...	...	...	...	...	...	...	...	...	...	...	...

* Initials of Stations, D. = Druridge, &c.

PLAICE.—Continued.

Inches.	CAMBOIS BAY.				DRURIDGE BAY.					BLYTH BA		
	June 28, 1902.	July 2, 1902.	July 23, 1902.	Total.	Aug. 1, 1900.	Aug. 6, 1900.	Sept. 12, 1900.	Sept. 12, 1901.	Aug. 20, 1902.	Sept. 5, 1900.	Sept. 11, 1902.	S 1
4—	...	...	...	...	2	...	...	...	...	...	...	
5—	...	3	3	6	15	11	...	2	...	3	1	
6—	11	21	10	42	4	4	1	11	6	18	16	
7—	14	25	35	74	11	1	1	15	3	11	6	
8—	20	28	24	72	7	10	4	8	5	3	8	
9—	9	17	19	45	5	12	10	16	15	9	29	
10—	4	2	7	13	4	10	5	35	20	4	29	
11—	6	3	4	13	5	1	14	19	10	2	11	
12—	6	3	4	13	3	4	6	10	34	...	4	
13—	1	1	1	3	8	1	6	...	30	1	10	
14—	2	...	1	3	4	3	1	...	14	1	1	
15—	...	1	...	1	7	...	1	...	2	...	...	
16—	...	...	...	...	3	...	...	...	2	...	...	
17—	...	...	...	...	...	...	...	...	1	...	...	
18—	...	...	...	...	...	...	...	...	...	...	...	
19—	...	...	...	...	...	...	1	...	1	...	...	
20—	...	...	...	...	...	...	...	...	...	...	...	
21—	...	...	...	...	...	...	...	...	...	...	...	
22—	...	...	...	...	1	...	...	...	...	...	...	

Inches.	1899.				1900.			1901.	1902.									1903.				
	A. July 5.	D. July 26.	C. Aug. 16.	C. Aug. 30.	C. July 11.	A. Aug. 14.	D. Sept. 12.	D. July 31.	C. June 28.	C. July 2.	C. July 23.	A. July 9.	A. July 30.	A. Aug. 27.	D. July 16.	D. Aug. 20.	B. Sept. 11.	D. July 15.	D. Aug. 12.	D. Sept. 9.	B. July 23.	C. Aug. 26.
4—	...	...	1	...	...	6	4	...	...	...	1	...	1	...	...	...	...	...	...	...	...	...
5—	...	...	2	2	8	22	24	1	...	...	...	2	2	2	...	3	...	...	...	...	...	6
6—	...	1	22	2	17	3	7	1	6	28	28	24	22	10	2	13	2	7	5	...	3	12
7—	11	25	92	18	28	1	2	35	26	58	36	68	46	72	24	46	14	34	37	24	41	59
8—	24	25	36	20	19	4	5	30	15	26	15	13	19	34	14	52	26	18	73	27	41	20
9—	20	10	11	2	5	7	13	16	4	9	7	7	13	9	9	26	16	15	36	13	13	10
10—	10	5	3	...	3	6	8	3	2	5	3	2	7	6	3	12	6	6	17	10	3	6
11—	3	2	1	2	...	5	7	...	2	3	4	3	...	1	1	4	1	2	4	3	...	1
12—	...	1	...	...	...	2	1	...	2	1	2	...	...	1	...	1	...	2	1	...	...	2
13—	1	1	1	1	...	1	...	...	...	1	3	1	...	...	...	...	...	...	...	...	...	..
14—	...	...	...	...	...	..	1	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...
15—	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...

FLOUNDER.

Inches.	ALNMOUTH BAY.						C.
	1899. July 5.	1899. Sept. 6.	1900. June 29.	1900. July 25.	1900. Aug. 14.	1901. Aug. 14.	1900. July 11.
5—	...	...	2	5	...	...	...
6—	1	5	1	5	3	4	5
7—	4	5	9	12	7	13	8
8—	4	9	16	14	11	19	13
9—	4	6	5	12	14	4	2
10—	3	2	1	3	4	2	...
11—	2	1	...	...	1	...	...

V.—STATISTICAL ACCOUNT.

A.—Northumberland, not including North Shields.—The tches of the fishermen, belonging to the fishing ports on the coast her than North Shields, are made within the Committee's district, d only rarely in the waters outside it. A consideration of the in- rmation available with regard to these is necessary to render more mplete the account which has already been given.

The government statistics for the years 1895 to 1905 are ranged in Table XV. so as to show the catches for the two visions of the county, the northern and the southern, which have eady been shown to differ so much physically, and also with gard to the relative proportions of fish and of crabs. In Table VI., the average annual catch of each of the species separately dis- nguished is given. In Chart 5 are a series of diagrams con- ucted from the figures in these tables, to show the character of e fishing during the year, and the changes which have taken ace in the period of eleven years.

The statistics are not absolutely accurate, and returns are not ade from three stations in the district, but the broad results are esented with sufficient accuracy for our purpose, and the figures the successive years agree in demonstrating them. It is unfor- nate that dabs have only been separately distinguished since 1902, t the catches of plaice, together with other important white fish, ve been recorded for the period under consideration.

It is at once plain that while the catches of certain species, *e.g.*, ddock and dab, are not very diffierent in the two divisions of the unty, there is a marked contrast in the case of cod, and flat fish, pecially plaice. In the northern district, the catches of cod, which mainly codling, with small cod, are nearly double, and of plaice arly twenty times those of the southern district. In the northern trict, moreover, there are caught more gurnards, anglers, conger s, and skate. It is only in the case of ling and whiting that the ches on the whole are greater in the southern half of the county.

The catching power in the two districts is certainly not quite ual. In 1904, the cobles and mules of the northern area numbered , and the cobles of the southern district, 78 (including Almonth, ble, and Cresswell, from which returns are not collected), not nting such as are employed for salmon or trout fishing only. aring this in mind it may be concluded that the species of round h which are predominant in the northern district are cod, gurnard,

TABLE XV.—**Catches of White Fish (in cwts.) in the Northumberland District, excluding North Shields. (Herring and Mackerel omitted.)**

NORTHERN DISTRICT, 1895.

Month.	Cod.	Haddock.	Hake.	Ling.	Whiting.	Skate.	Other Kinds.	Total.	Dab.	Halibut.	Plaice.	Turbot.	Sole.	Flat Fish.	Total White.
January ...	558	884		10			368	1820		...	...	...		...	1820
February ...	578	2741		19			404	3742		...	41	...		41	3783
March ...	1027	2848		19			623	4517		...	387	...		387	4904
April ...	755	1965		13			324	3057		1	170	...		171	3228
May ...	563	2391		16			352	3322		4	34	1		39	3361
June ...	557	1219		8			525	2309		...	144	...		144	2453
July ...	303	389		18			1216	1926		...	82	8		90	2016
August ...	359	289		23			1509	2180		2	79	22		103	2283
September ...	65	356		8			868	1297		...	35	37		72	1369
October ...	236	1614		5			120	1975		...	43	12		55	2030
November ...	463	2065		8			243	2779		...	31	...		31	2810
December ...	1238	2073		13			387	3711		...	2	...		2	3713
	6702	18834		160			6939	32635		7	1048	80		1135	33770

SOUTHERN DISTRICT, 1895.

January ...	370	877		42			70	1359			...			...	1359
February ...	450	1639		13			108	2210			...			...	2210
March ...	966	1582		85			195	2828			2			2	2830
April ...	797	1774		107			652	3330			9			9	3339
May ...	1287	1366		188			307	3148			...			...	3148
June ...	860	1106		122			491	2579			...			...	2579
July ...	125	179		10			404	718			...			...	718
August ...	25	49		...			399	473			...			...	473
September ...	21	167		...			232	420			...			...	420
October ...	100	801		5			72	978			...			...	978
November ...	206	1218		65			282	1771			...			...	1771
December ...	175	2221		4			341	2741			...			...	

	Cod.	Had	Hake	Ling	Whit	Skate	Other Kind	Total	Dab.	Halib	Plaice	Turbot	Sole.	Flat F	Total White
January ...	1231	5035		14			265	6548		...	1	...	...	1	6549
February ...	387	1836		5			325	2553		...	37	...	...	37	2590
March ...	314	752		7			319	1392		1	104	...	...	105	1497
April ...	324	1094		12			429	1859		6	92	...	1	99	1958
May ...	330	690		8			531	1559		5	70	...	...	75	1631
June ...	295	691		19			705	1713		1	17	...	...	18	1731
July ...	210	266		8			1302	1786		...	15	2	...	17	1803
August ...	71	28		...			1315	1417		...	13	41	...	54	1471
September ...	94	159		3			1219	1475		...	11	26	...	40	1515
October ...	157	557		5			295	1014		...	25	6	...	31	1045
November ...	659	1787		11			742	3202		...	1	2	...	3	3205
December ...	482	1658		16			475	2631		1	...	...	...	1	2632
	4560	14556		111			7922	27149		11	389	77	1	481	27630

SOUTHERN DISTRICT, 1896.

January ...	159	6072		7			685	6923			...	...		...	6923
February ...	135	3018		2			459	3614			3	...		3	3647
March ...	101	1121		25			176	2023			4	...		4	2027
April ...	210	805		25			150	1190			22	...		22	1212
May ...	695	262		65			180	1202			5	...		5	1207
June ...	231	157		21			262	671			...	...		...	671
July ...	40	43		...			336	419			...	...		...	419
August ...	...	81		...			309	390			...	1		1	391
September ...	17	96		7			180	330			...	...		...	330
October ...	171	746		12			111	1043			...	...		...	1043
November ...	396	1759		21			350	2526			...	...		...	2526
December ...	399	1711		17			259	2386			...	...		...	2386
	2584	16201		205			3760	22750			34	1		35	22785

TABLE XV.—Continued.—Northern District, 1897.

Month.	Cod.	Haddock.	Hake.	Ling.	Whiting.	Skate.	Other Kinds.	Total.	Dab.	Halibut.	Plaice.	Turbot.	Sole.	Flat Fish.	Total White.
January ...	269	1982		26			191	2468		...	...	...		...	2468
February ...	287	3035		10			499	3831		2	62	...		64	3895
March ...	83	173		5			220	481		...	10	...		10	491
April ...	255	501		9			173	938		1	13	...		14	952
May ...	256	261		8			264	789		6	2	...		8	797
June ...	358	259		11			476	1104		3	...	...		3	1107
July ...	244	199		65			683	1191		...	10	3		13	1204
August ...	105	33		26			752	916		1	...	45		46	962
September ...	45	175		4			452	676		...	4	24		28	704
October ...	215	589		7			93	904		...	15	4		19	923
November ...	448	585		3			166	1202		...	22	2		24	1226
December ...	679	916		8			336	1939		...	11	...		11	1950
	3244	8708		182			4305	16439		12	149	78		240	16679

Southern District, 1897.

January ...	115	2216		1			109	2171		...	...			...	2171
February ...	226	1809		8			582	2625		...	5			5	2630
March ...	45	275		9			344	673		...	2			2	675
April ...	136	588		53			98	875		...	...			...	875
May ...	489	108		116			97	810		...	...			...	810
June ...	439	32		111			184	766		...	...			...	766
July ...	49	17		...			292	358		...	...			...	358
August ...	28	122		...			276	426		...	...			...	426
September ...	16	113		...			120	249		...	...			...	249
October ...	64	559		13			66	702		...	...			...	702
November ...	90	720		7			292	1109		...	...			...	1109
December ...	179	1625		21			607	2435		1	...			1	2436

Month.	Cod.	Haddock	Hake.	Ling.	Whiting	Skate.	Other Kinds.	Total.	Dab.	Halibut	Plaice.	Turbot	Sole.	Flat Fish.	Total White.
January ...	783	1712	..	8			331	2834		...	4	...		4	2838
February ...	117	381	...	3			165	696		...	5	...		5	701
March ...	195	139	...	5			132	471		3	44	...		47	518
April ...	156	91	...	22			179	448		3	5	...		12	460
May ...	315	183	...	21			241	766		5	...	...		5	771
June ...	437	115	...	40			322	941		3	6	...		9	953
July ...	126	76	...	28			541	771		...	1	7		8	782
August ...	87	16	...	7			858	968		...	...	28		28	996
September ...	111	82	...	2			806	1001		...	...	10		10	1011
October ...	371	251	...	4			124	750		...	31	4		35	785
November ...	427	263	14	3			223	930		...	41	...		41	971
December ...	735	431	...	1			65	1232		...	17	...		17	1249
	3893	3770	14	147			3990	11814		18	154	49		221	12035

Southern District, 1898.

January ...	375	5407		20			323	6125			...			...	6125
February ...	251	961		10			135	1357			...			...	1357
March ...	109	381		15			78	583			1			1	584
April ...	145	176		56			47	421			...			...	421
May ...	122	33		56			59	270			...			...	270
June ...	107	40		41			196	384			...			...	384
July ...	47	41		...			368	456			...			...	456
August ...	31	26		...			361	418			...			...	418
September ...	10	93		...			191	294			4			4	298
October ...	80	357		14			202	653			3			3	656
November ...	171	512		17			133	833			...			...	833
December ...	99	792		25			94	1010			...			...	1010
	1547	8819		254			2187	12807			8			8	12815

TABLE XV.—Continued.—Northern District, 1899.

Month.	Cod.	Haddock.	Hake.	Ling.	Whiting.	Skate.	Other Kinds.	Total.	Dab.	Halibut.	Plaice.	Turbot.	Sole.	Flat Fish.	Total White.
January ...	910	355		6			96	1367		...	9	...		9	1376
February ...	739	307		3			147	1196		...	25	...		25	1221
March ...	397	57		13			192	659		1	68	...		69	728
April ...	223	67		25			217	532		2	27	...		29	561
May ...	213	165		29			287	694		6	15	..		21	715
June ...	213	210		3			447	873		...	...	...		...	873
July ...	131	87		9			965	1192		...	1	2		3	1195
August ...	78	28		2			1046	1154		...	...	17		17	1171
September ...	74	36		1			278	389		...	2	17		19	408
October ...	272	213		2			103	590		...	31	1		32	622
November ...	659	238		...			111	1008		...	23	...		23	1031
December ...	387	274		2			89	752		...	8	...		8	760
	4296	2037		95			3978	10406		9	209	37		255	10661

Southern District, 1899.

January ...	241	1498		20			250	2009			...			...	2009
February ...	290	646		9			218	1163			...			...	1163
March ...	177	236		18			198	629			...			...	629
April ...	94	284		15			305	698			...			...	698
May ...	61	169		18			184	432			...			...	432
June ...	50	42		31			263	386			...			...	386
July ...	16	17		...			376	409			...			...	409
August ...	13	7		...			291	311			...			...	311
September ...	16	20		2			105	143			2			2	145
October ...	94	427		19			227	767			19			19	786
November ...	67	180		8			141	396			...			...	396
December ...	180	273		5			115	573			...			...	573

Month.	Cod.	Haddo	Hake.	Ling.	Whitin	Skate.	Other Kinds.	Total.	Dab.	Halibu	Plaice.	Turbot.	Sole.	Flat Fi	Total White.
January ...	1080	422		8			114	1624		...	31	...		31	1655
February ...	753	328		4			166	1251		...	30	...		30	1281
March ...	408	107		6			175	696		...	12	...		12	708
April ...	219	47		27			215	508		6	31	...		37	545
May ...	201	75		41			302	622		13	7	...		20	642
June ...	158	90		4			346	598		...	...	...		...	598
July ...	111	87		...			846	1047		...	...	...		...	1047
August ...	60	25		...			1221	1306		...	...	3		3	1309
September ...	68	40		2			816	926		...	34	10		44	970
October ...	221	159		...			68	448		...	79	1		80	528
November ...	519	217		4			56	826		...	33	...		33	859
December ...	691	226		...			20	940		...	12	...		12	952
	4525	1823		99			4315	10792		19	269	14		302	11094

SOUTHERN DISTRICT, 1900.

January ...	436	500		2			119	1057			...			...	1057
February ...	133	278		2			95	508			...			...	508
March ...	229	121		33			109	492			...			...	492
April ...	74	63		19			101	257			8			8	265
May ...	70	36		39			70	215			...			...	215
June ...	30	20		6			139	195			...			...	195
July ...	6	3		...			292	301			...			...	301
August ...	2	...		...			471	473			...			...	473
September ...	4	33		...			117	154			5			5	159
October ...	83	182		2			203	470			...			...	470
November ...	197	215		10			203	625			...			...	625
December ...	122	164		9			265	560			...			...	560
	1386	1615		122			2184	5307			13			13	5320

TABLE XV.—Continued.—Northern District, 1901.

Month.	Cod.	Haddock.	Hake.	Ling.	Whiting.	Skate.	Other Kinds.	Total.	Dab.	Halibut.	Plaice.	Turbot.	Sole.	Flat Fish.	Total White.
January ...	843	253		...			113	1209		...	9	...		9	1218
February ...	749	244		5			286	1284		...	17	...		17	1301
March ...	278	31		...			248	557		...	60	...		60	617
April ...	216	21		24			316	577		5	106	...		111	688
May ...	218	120		20			359	717		6	4	...		10	727
June ...	100	66		1			387	554		...	3	...		3	557
July ...	86	46		16			772	920		...	...	4		4	924
August ...	49	9		16			1034	1108		...	...	5		5	1113
September ...	43	32		...			741	816		...	2	9		11	827
October ...	441	235		3			50	729		...	50	3		53	782
November ...	779	158		...			39	976		...	14	...		14	990
December ...	1064	210		1			23	1298		...	7	...		7	1305
	4866	1425		86			4368	10745		11	272	21		304	11049

Southern District, 1901.

January ...	346	242		3			135	726			...			...	726
February ...	451	449		11			144	1055			...			...	1055
March ...	195	34		4			52	285			...			...	285
April ...	85	80		9			115	289			2			2	291
May ...	49	22		12			85	168			...			...	168
June ...	11	...		...			105	116			...			...	116
July ...	6	...		...			237	243			...			...	243
August ...	6	...		...			246	252			...			...	252
September ...	3	24		...			51	78			5			5	83
October ...	26	137		4			92	259			15			15	274
November ...	81	165		7			217	470			...			...	470
December ...	120	151		4			446	721			...			...	721

Month.	Cod.	Haddock	Hake.	Ling.	Whiting.	Gurnard	Conger Eel.	Skate.	Other Kinds.	Total.	Dab.	Halibut.	Plaice.	Turbot.	Sole.	Flat Fish	Total White.
January ...	1722	318		6	3	...	...	...	123	2172	1	...	23	...		24	2196
February ...	1455	357		5	4	3	...	5	81	1610	8	...	19	...		27	1637
March ...	924	76		46	5	...	...	5	184	1240	5	6	139	...		150	1390
April ...	219	48		73	13	10	...	19	189	571	10	13	23	...		46	617
May ...	141	63		48	1	6	...	10	369	641	10	8	12	...		30	671
June ...	60	37		...	...	...	...	...	588	685	1	...	2	...		6	691
July ...	44	18		17	...	...	12	8	912	1011	6	3	1	1		11	1022
August ...	58	18		19	18	...	52	...	1132	1297	12	...	...	1		13	1310
September ...	64	48		4	4	...	8	4	1032	1164	5	...	9	2		16	1180
October ...	618	225		...	8	1	...	...	21	903	13	...	64	...		77	980
November ...	584	206		...	7	...	...	...	26	823	7	...	14	...		21	844
December ...	922	204		4	4	...	...	...	26	1160	9	...	5	...		14	1174
	6544	1618		222	67	20	72	51	4683	13277	90	30	311	4		435	13712

Southern District, 1902.

January ...	439	161		1	12	...	...	...	471	1087	2		...			2	1089
February ...	519	130		1	10	...	...	...	444	1104	5		...			5	1109
March ...	910	128		15	11	...	...	...	...	1067	26		8			31	1101
April ...	135	63		13	15	...	...	...	...	226	16		...			16	242
May ...	43	17		12	27	...	...	1	5	105	5		...			5	110
June ...	23	6		2	7	3	...	...	113	151	2		...			2	156
July ...	8	...		...	...	...	...	...	460	468	2		...			2	470
August ...	6	...		...	...	...	...	...	553	559	...		...			...	559
September ...	1	6		3	...	...	2	...	70	85	...		6			6	91
October ...	176	360		30	27	3	...	2	...	598	16		36			52	650
November ...	320	211		10	23	...	...	...	4	571	2		...			2	573
December ...	281	128		6	15	...	...	...	88	518	2		...			2	520
	2861	1213		93	150	6	2	3	2211	6542	78		50			128	6670

TABLE XV.—Continued.—Northern District, 1903.

Month.	Cod.	Haddock.	Hake.	Ling.	Whiting.	Catfish.	Gurnard.	Angler.	Conger Eel.	Skate.	Other Kinds.	Total.	Brill.	Dab.	Halibut.	Plaice.	Turbot.	Sole.	Flat Fish.	Total White.
January ...	1252	189	...	12	2	...	4	...	...	...	6	1465	...	12	...	22	...	...	34	1499
February ...	665	107	...	6	12	...	10	2	...	8	33	843	...	9	...	62	...	...	71	914
March ...	456	132	...	12	2	...	6	...	...	7	36	651	...	11	2	214	...	...	227	878
April ...	174	96	...	15	5	...	3	...	...	3	251	547	...	6	1	15	...	...	22	569
May ...	329	198	...	28	25	2	3	4	...	10	172	771	...	13	4	34	1	3	55	826
June ...	248	210	...	41	10	...	...	...	...	1	409	919	...	8	1	8	...	...	17	936
July ...	70	41	...	3	...	...	...	...	2	...	485	601	...	6	...	...	...	...	6	607
August ...	59	45	3	11	...	...	...	...	39	4	1040	1201	...	8	...	10	3	...	21	1222
September ...	78	66	...	...	...	...	4	6	11	...	859	1027	1	7	...	5	8	...	21	1048
October ...	495	372	...	2	15	...	2	2	...	...	4	892	...	36	...	73	...	...	109	1001
November ...	778	545	...	4	8	...	...	...	...	...	6	1341	...	25	...	17	...	1	43	1384
December ...	1053	717	...	7	8	...	...	...	...	...	...	1785	...	9	...	...	...	...	9	1794
	5657	2718	3	141	87	2	32	14	55	33	3301	12043	1	150	8	460	12	4	635	12678

Southern District, 1903.

January ...	1296	184		3	...	...	...		...		20	1503		2	...	...			2	1505
February ...	521	81		2	...	...	...		...		...	604		3	...	...			3	607
March ...	316	66		6	...	2	...		...		...	390		21	...	2			23	413
April ...	88	89		9	...	3	...		...		...	189		9	...	...			9	198
May ...	39	56		12	16	4	...		...		18	145		6	...	...			6	151
June ...	53	24		1	82	...	...		...		144	304		...	...	...			...	304
July ...	16	11		1	...	...	...		...		276	304		7	...	...			7	311
August ...	6	2		...	5	...	...		...		393	406		3	...	...			3	409
September ...	39	61		4	16	...	...		...		38	161		6	...	11			17	178
October ...	334	346		14	95	...	2		2		...	793		15	...	1			16	809
November ...	384	474		40	82	...	...		9		...	989		9	1	...			10	999
December ...	569	736		24	25	...	...		4		...	1358		2	...	...			2	1360
	3661	2133		116	321	9	2		15		889	7146		83	1	14			99	

Month.	Cod.	Haddo	Hake.	Ling.	Whitin	Catfish	Gurnar	Angler.	Conger Eel.	Skate.	Other Kinds.	Total.	Brill.	Dab.	Halibut.	Plaice.	Turbot.	Sole.	Flat Fish	Total White.
January ...	851	591		8	4		...	...	1	1	1	1469		3	...	3	1		7	1176
February ...	573	200		25	1		...	1	2	5	30	840		1	...	38	...		42	882
March ...	175	120		23	9		...	...	...	5	46	678		5	...	95	1		101	779
April ...	297	91		15	5		...	...	...	11	52	171		3	...	56	...		59	530
May	271	109		15	11		5	8	...	13	115	550		10	...	30	...		40	590
June ...	192	119		22	5		3	2	1	7	388	739		4	2	7	1		17	756
July	84	36		32	...		...	...	16	6	1022	1196		3	3	...	...		6	1202
August ...	113	39		26	...		3	...	20	...	928	1129		6	...	...	6		12	1141
September ...	131	67		11	...		...	...	8	...	620	840		3	...	3	1		7	847
October ...	445	277		4	16		...	...	...	...	8	750		27	...	51	...		78	828
November ...	556	303		3	7		...	...	...	3	...	872		35	...	4	...		39	911
December ...	921	361		2	3		...	...	...	...	...	1287		9	...	...	...		9	1296
	4912	2316		189	64		11	11	48	51	3213	10821		112	5	287	13		117	11238

Southern District, 1901.

anuary ...	1051	906		10	3	...			...	...	...	1970		10		...			10	1980
February ...	658	161		1	...	...			...	...	...	823		7		...			7	830
March ...	416	231		15	7	1			...	...	...	670		12		2			11	681
April ...	207	169		22	18	11			...	...	...	430		11		6			17	447
May	68	39		8	19	2			...	...	5	141		4		...			4	145
June ...	50	11		7	21	...			...	...	31	126		...		...			...	126
July	31	17		...	1	...			...	...	283	335		...		...			...	335
August ...	15	7		...	...	...			...	...	233	255		...		...			...	255
September ...	39	61		13	10	...			13	...	11	207		3		1			4	211
October ...	330	221		23	71	...			2	15	...	662		32		...			32	694
November ...	311	211		27	67	...			1	...	...	683		15		...			15	698
December ...	510	221		20	7	...			2	...	...	790		9		...			9	799
	3749	2291		179	224	17			21	15	596	7092		103		9			112	7204

TABLE XV.—Continued.—Northern District, 1905.

Month.	Cod.	Haddock.	Hake.	Ling.	Whiting.	Catfish.	Gurnard.	Angler.	Conger Eel.	Skate.	Other Kinds.	Total.	Brill.	Dab.	Halibut.	Plaice.	Turbot.	Sole.	Flat Fish.	Total White.
January ...	673	235		14	3	...			1	1	...	927		...	...	2	...		2	929
February ...	667	156		35	6	...			3	4	130	1001		...	3	7	...		10	1011
March ...	505	99		45	3	...			...	4	85	741		...	6	106	...		112	853
April ...	227	83		16	2	...			...	...	199	527		...	1	14	...		15	542
May ...	444	127		34	9	...			...	16	411	1041		..	5	10	...		15	1056
June ...	221	79		27	27	...			...	41	627	1022		6	4	4	...		14	1036
July ...	93	46		54	...	25			...	20	627	865		4	...	...	...		4	869
August ...	117	37		42	10	...			29	4	902	1141		6	...	...	...		6	1147
September ...	104	52		12	5	...			10	8	501	692		...	...	2	14		16	708
October ...	499	237		7	20	...			...	...	..	763		23	...	16	...		39	802
November ...	709	327		...	20	...			...	...	22	1078		19	...	14	...		33	1111
December ...	926	422		10	32	...			...	...	3	1393		10	...	2	...		12	1405
	5185	1900		296	137	25			43	98	3507	11191		68	19	177	14		278	11469

Southern District, 1905.

January ...	709	134		13	...	...					...	856		...	...	...		...	...	856
February ...	731	373		30	3	10					...	1147		...	...	...		...	...	1147
March ...	840	154		77	3	..					...	1074		19	...	1		...	20	1094
April ...	33	51		68	7	7					...	166		3	1	...		...	4	170
May ...	78	38		35	57	...					52	260		...	...	...		...	...	260
June ...	24	24		16	...	...					288	352		...	...	...		...	...	352
July ...	58	41		14	46	...					668	827		...	...	...		...	...	827
August ...	35	59		18	78	...					754	944		...	...	...		...	...	944
September ...	66	44		28	21	...					6	165		...	...	...		...	...	165
October ...	393	254		45	36	...					...	728		...	...	7		...	7	735
November ...	643	563		23	109	...					...	1338		...	...	3		3	6	1344
December ...	894	521		49	219	...					...	1683		...	...	...		...	...	1683
	4504	2256		416	579	17					1768	9540		22	1	11		3	37	9577

Month.	Cod.	Haddock	Hake.	Ling.	Whiting	Catfish.*	Gurnard.	Angler.*	Conger Eel.	Skate	Brill.**	Dab.*	Halibut.	Plaice.	Sole.	Turbot.
January ...	925	1089	-	10	3	-	1	-	1	1	-	4	-	10	-	·1
February ...	609	881	-	11	6	-	3	2	1	6	-	5	·5	31	-	-
March ...	160	412	-	16	5	-	1	-	-	5	-	3	2	113	-	·1
April ...	279	373	-	23	6	-	3	-	-	8	-	5	4	50	·1	-
May ...	299	398	-	25	12	1	4	4	-	12	1	8	5	20	·3	·2
June ...	258	281	-	16	10	-	1	1	1	12	-	5	1	17	-	·3
July ...	137	117	-	23	1	3	-	-	7	9	-	3	·5	10	-	2
August ...	105	52	1	16	7	-	1	-	35	2	-	8	·5	9	-	16
September ...	80	101	-	5	2	-	1	2	10	3	-	1	-	10	-	11
October ...	364	130	-	3	15	-	1	1	-	-	-	25	-	43	-	3
November ...	601	609	1	3	10	-	-	-	-	1	-	22	-	20	·1	·3
December ...	827	681	-	6	12	-	-	-	-	-	-	9	·5	6	-	-
	1944	5127	2	157	88	9	16	10	55	59	1	105	14	339	·5	36

Southern District.

January ...	506	1651		11	4	-	-		-	-		3	-	-	-	-
February ...	397	870		8	3	3	-		-	-		1	-	1	-	-
March ...	391	421		27	6	1	-		-	-		19	-	2	-	-
April ...	182	377		36	10	3	-		-	-		10	·1	1	-	-
May ...	273	195		51	30	2	-		-	1		4	-	1	-	-
June ...	171	133		33	27	-	1		-	-		1	-	-	-	-
July ...	37	31		2	12	-	-		-	-		2	-	-	-	-
August ...	15	32		1	21	-	-		-	-		1	-	-	-	·1
September ...	24	65		8	12	-	-		1	-		2	-	3	-	-
October ...	168	399		16	57	-	1		1	1		16	-	7	-	-
November ...	263	569		21	70	-	-		3	-		6	·1	1	·3	-
December ...	324	777		17	66	-	-		1	-		3	·1	-	-	-
	2751	5526		231	318	11	2		9	5		71	·3	19	·3	·1

* 1902-1905. ** 1903-1905. *** 1903.

angler, conger eel, and under this category may be included skate, and all the flat fish with the exception of the dab. In the southern district the fishermen catch more haddock, ling, whiting, and about as many dabs.

This contrast between the two areas was shown to be particularly striking in the account of the crab fisheries of the county in the last report. It was pointed out that the larger area at the disposal of the crabs was sufficient to account for the greater success of the crab fishermen in the northern district. It is now evident that the physical features have an influence, which may be explained by saying that a nearer approach to the coast is permitted to such fish as affect a soft bottom in the southern district, whereas in the north they are restricted to isolated areas in the hard ground, and to the region outside. In the northern region, for the same reason, a larger population of fish which affect hard ground or its neighbourhood can be accommodated, and the food supply is greater.

In the account of the trawling experiments the conclusions referred perforce to the flat fish, and it is now clear from the above that the difference between the two districts is greater than even our experiments have shown. The inference derived from the experiences of the fishermen points to the desirability of obtaining some accurate information by the employment, especially of experiments of the nature which have been described here as the "first haul," at certain stations in deeper water within and immediately without the district, and at other seasons than that in which we have been in the habit of trawling.

The figures in Chart 5 showing the catches per month serve to indicate that the shoreward movement of haddocks, noted by Pennant for our coast, and described by the Rev. Cooper Abbs, Sunderland, still takes place. But if the accounts given by these writers are to be trusted, there can be no doubt that a considerable diminution in the intensity of this immigration of the haddock has taken place since the 18th century. The latter writer* recorded a remarkable decline in the catches of the fishermen in the counties of Northumberland, Durham, and York, in 1789, and the two or three following years; and pointed out, "As far back as the memory of the oldest man reaches, for three months in the year (beginning about Martinmas), prodigious quantities of haddocks, in fine weather,

* T. R. S., 1792.

daily caught on the above coasts, which gave employment to
numbers of men. The shoal generally lay about one league
the shore, was about three miles in breadth, and in length
ded near the whole coast of the three counties in constant
ssion for about three months." He connected the cause of
ecline with the observations which had been communicated by
ins of vessels that large quantities of haddock and cole fish had
seen in a dead or dying condition over a large area near the
en Islands. And this at once brings the interesting modern
y of the tile fish of American waters to mind.

addition to the haddock and codling, whitings join in this
gration at the end of the year, and a number of bibs and poor
ppear among the catches as well. Another immigration on the
f the whiting, with the shoals of small-size stages takes place
early part of the summer, when ling are caught also in maxi-
numbers.

ie catches of plaice are mainly made, with those of dabs, in the
is of February to April, and in October and November, for the
part by the Berwick, Holy Island, and Sea Houses fishermen.
nshore waters, therefore, appear to receive immigrations at
periods in addition to the short one which our experiments
shown to take place in the summer.

ie figures for the eleven years show that a great decline has
place in the catches of haddock, plaice, and turbot in the
art of this period. The reason in the case of turbot is that
hermen of the northern district have been giving up the use
turbot or brat nets, as the men of the southern district did, with
eption of those at Boulmer, many years ago. It is only prose-
and, in a very reduced degree at Craster. Brat net fishing is
historical, therefore, with regard to the majority of Northum-
l stations, and it is now threatened with extinction. There
no question that during the period which has witnessed the
in this method of fishing, turbot have also considerably
ed in numbers. Moreover, the trawling experiments in spite
decline in the fishing, do not point to any improvement in the
rs of turbot. In the case of plaice it will be noticed that
ie diminution referred to ceased in 1897, an improvement
en place, which, when presented in diagram form is very
similar to that recorded for the trawling experiments.
re diagram 1 of Chart 2 with diagram 2 of Chart 5).

The severe falling off in the catches at the beginning of the period in question is more strikingly shown when the figures for the total white fish are presented, as in diagram 1 of Chart 5, from the returns of the fishery officers.

In another place I have given an historical account of the fisheries of Northumberland, but here it may be briefly stated that the modern diminution in the catches began about 1840-1850, just before the sailing trawlers from Hartlepool and Scarborough commenced to fish in the offshore waters of the coast of Northumberland.

B.—North Shields.—North Shields was little known as a fishing centre, although its connexion with fishing dates from the 13th century, until in 1877 steam tugs commenced trawling from the port. A screw trawler was introduced in 1879, and this class of boat increased rapidly in numbers. The first otter trawl was introduced in 1895, and the beam trawl soon became a thing of the past. About five tugs continue trawling from North Shields, using, however, otter trawls. The progress of this port during this period of its history is shown by the following statement which I have prepared from the returns furnished for the information of the Corporation by the quay master, Mr. McKenzie (page 86).

VI.—PROTECTION.

This review of the white fisheries of the district has shown that the smaller ports have gradually declined since about the middle of last century, and particularly in the last 25 years, during the period in fact which has witnessed the rise of North Shields to the position of a first-class port, through the developments in steam trawling and lining. In this period there has been at the smaller ports a rise in the crab fishing.

The diminution began in fact with the modern development of sea fisheries, even before sailing and subsequently steam trawling added so much to the catching power. That it has been gradual may be gathered from comparative statements from time to time as to the catches on certain grounds, and with regard to our own district on well known areas within and immediately without it.

The appeal which has been made to statistics shows that even so recently as from and before 1895 to about 1900, a considerable falling off took place in the catches of the inshore fishermen, since when a slight improvement is shown to have occurred. It is admitted that the diminution is due to some extent to the fishermen

ing up line fishing and devoting their energies more to crab, and must be added, to trout and salmon fishing. This is especially case in the northern half of the district, but the southern division icates a practically parallel history with regard to the catches.

As is shown, however, in diagram 2 of Chart 5, the catches plaice do not indicate much change in the southern area, while in northern region there was a falling off to the year 1897, since en an improvement has occurred which is very similar, as has n pointed out, to what has been shown to have resulted from experiments.

In the case of prime fish the trawling experiments do not indicate ch. There is evidence which I have published in previous reports affirming that both turbot and soles were, not more than two, or most three decades back, caught in fairly large numbers. Soles now seldom obtained in the Northumberland district, and turbot ing, as has been shown, has recently undergone a considerable ression. In the latter case especially it might have been expected t because of this decline in the fishing the species would have reased in numbers, and that the increase would have been demonated by the experiments. This has not happened.

It is not possible to say definitely how much of the decline in the ches of plaice is due to the fishermen giving up fishing, and how it may be considered to evidence an actual reduction in numbers. t I have in the above considerations given some of the reasons ich may be brought forward to indicate that the results are not irely due to a falling off in line fishing. I would point, moreover, he modern relative increase of cod, and the actual decrease of ldocks, which I have dwelt upon in previous reports, with especial erence to Berwick, where statistics of undoubted value have been ected for many years, to show that, as a matter of fact, a species y decline considerably, even when the fishing strength remains roximately the same.

While I grant, therefore, that our experimental results may e, probably do have, some connexion with the decrease in line ing, I am of the opinion that they are susceptible of explanation pendently of this consideration. The migration experiments e demonstrated that the inshore plaice of our district are practiy resident for the first four or five years of their lives. It may nferred, therefore, that if these young plaice are protected, the ies will increase in numbers, at all events up to about maturity. s is what I believe our experiments have proved.

It may be asked if this be the case, why has there been such a falling off during the past two years? I can only reply that the fishermen have experienced an exactly similar diminution in the catches of plaice, and that with no accompanying decline in the number of boats or men.

The byelaw which was passed the year before the experiments commenced, has, therefore, been of some degree of benefit to the district, and the experiments may be said, furthermore, to prove that the Northumberland inshore area is not unimportant as a rearing ground for plaice and dabs.

It may be said also that the byelaw gives a passing protection to such fish as migrate temporarily within the district.

It may be inferred, moreover, that other species, *e.g.*, cod and whiting, which pass a great part of their lives in the inshore waters, benefit by the protection which it has been the purpose of the byelaw to give.

The Committee have from time to time, recognising the decline in the inshore white fisheries, discussed the question whether anything further could be done to improve them. One result was an attempt to persuade trawl fishermen to artficially fertilize the ova of ripe fish during the spawning season. Some little success was obtained, but it was found impossible to get more than one or two of the skippers of trawlers to carry the method into practice, and the work on board a trawler it must be admitted leaves little time for doing so.

The question of artifically hatching the ova of the more important forms has also been raised,—see previous reports. For reasons which were given last year with reference to lobster hatching, and which have been set forth when the present question has been discussed in previous reports, it is not possible to admit that the setting free of artificially hatched larvæ in the sea would necessarily be productive of an increase in number of adult fish. At the same time experiments on as large a scale as possible are desirable to prove if it is possible to rear especially the rare and more valuable forms to a size when they could with more confidence be freed in carefully chosen localities, and even to see if they could be altogether reared in confined areas. The pond at Amble, to which reference is made on page 106, offers an opportunity to test this in our own district. But as the lobster fishing of the district is of paramount importance, the experiments when they are made should apply especially and primarily to that species.

The legislative methods which have been proposed have for their bject the protection of the young stages, by an enlargement of the esh of the net, or by imposing a size limit. Such measures are of ational importance and do not fall to be discussed in a paper ferring to Northumberland, although the wish may be expressed at the Board will soon receive the powers necessary to take action this and other matters affecting the fishing interests when it is ewn to be desirable.

One reason for the decline in the inshore fisheries is the difficulty obtaining mussel bait. The Warham mussel farm is being rked with moderate success by Mr. Mitchell, but it is altogether dequate to supply even the adjoining ports. An experiment, de some years ago in the Coquet, demonstrated that mussels uld be grown there successfully. The region has undergone some gree of change since then by the deepening of the harbour. An perimental plot has been laid out near the mouth of the harbour s year, 1905, which already shows that the region is admirably pted for mussel cultivation on a small scale. It is therefore ssible at such places, as the mouth of the Blyth and the Coquet form small scaups, but not scaups sufficiently large to pay for rking on a commercial scale. I have already suggested in a pre- us report on the subject that if the bait rights attached to these ces were acquired by the Committee, such small scaups could be ned and handed over for management to one or more of the rer fishing communities under the control of the Committee. It uld be worth while, moreover, to make a careful survey, with the sent of the owners, of Fenham Flats, and to experiment thereon ind out whether a mussel scaup could be formed there large ugh to be worked on commercial lines.

An enquiry on the subject of the mussel supply in Northumber- l is at present being made by Miss M. V. Lebour, B.Sc., and a ort will be published next year (see page 100).

The Weight of Herrings and White Fish landed at North Shields for the years ending 25th March, 1876 to 1905.

Year.	Herring.	White Fish.	Year.	Herring.	White Fish.
	Tons.	Tons.		Tons.	Tons.
1876	3000	372	1891	6530	6146
1877	3776	406	1892	4989	6650
1878	4078	999	1893	9352	8027
1879	4177	2288	1894	8488	8298
1880	5518	2430	1895	5857	8832
1881	6057	2572	1896	5091	9182
1882	7779	2344	1897	5499	7290
1883	5805	2490	1898	3924	8599
1884	5323	3511	1899	3231	9566
1885	8119	4328	1900	2574	10,430
1886	6097	4491	1901	5235	11,170
1887	9768	4314	1902	4605	12,186
1888	8025	4041	1903	5764	12,645
1889	8187	4171	1904	6469	12,841
1890	7674	4272	1905	6633	12,485

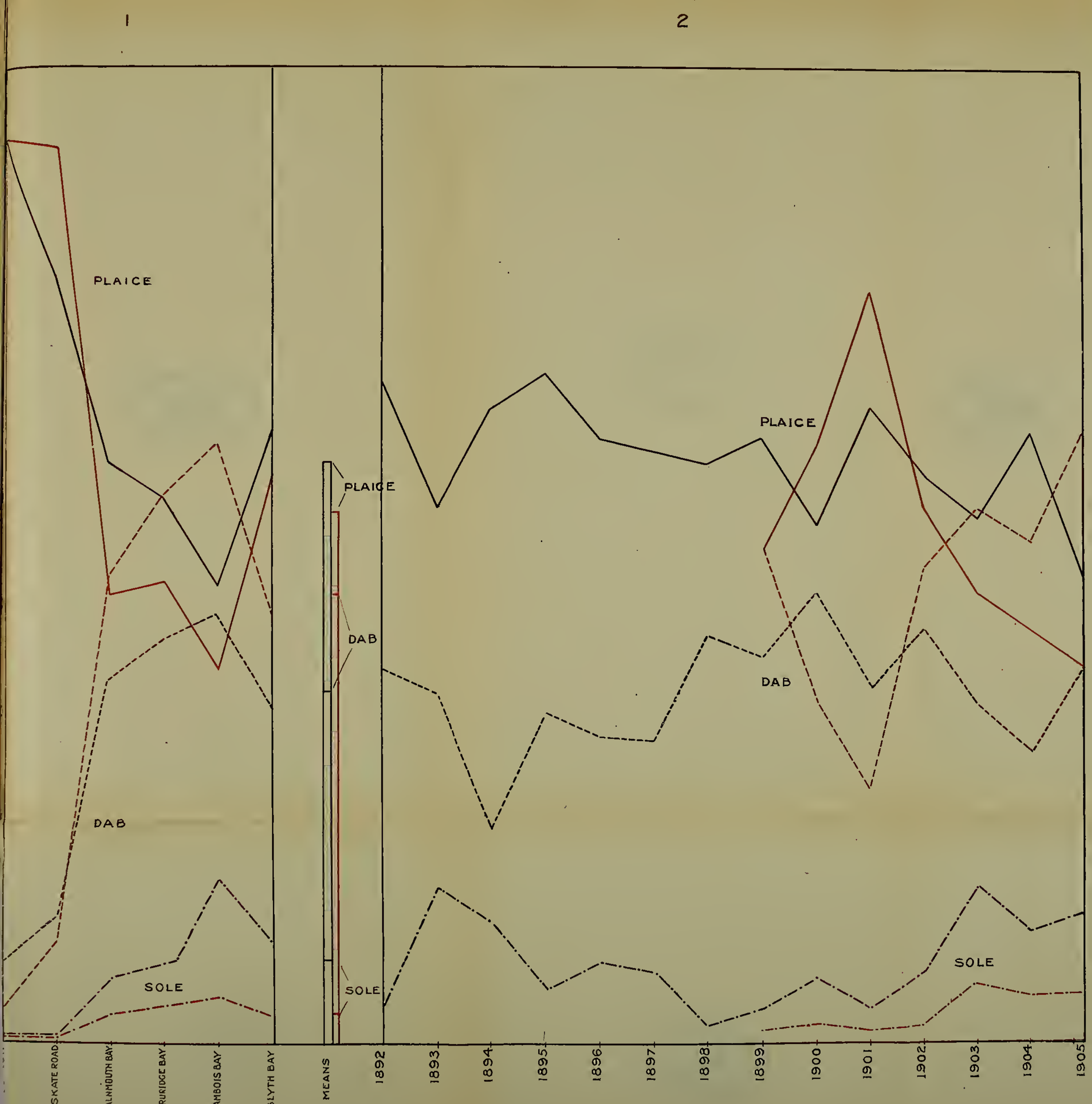


CHART I.

Proportional Catch of Flat Fish (1) at the different trawling stations, and (2) for the period of the 14 years.

Marketable Fish Black.
First Haul—Red.

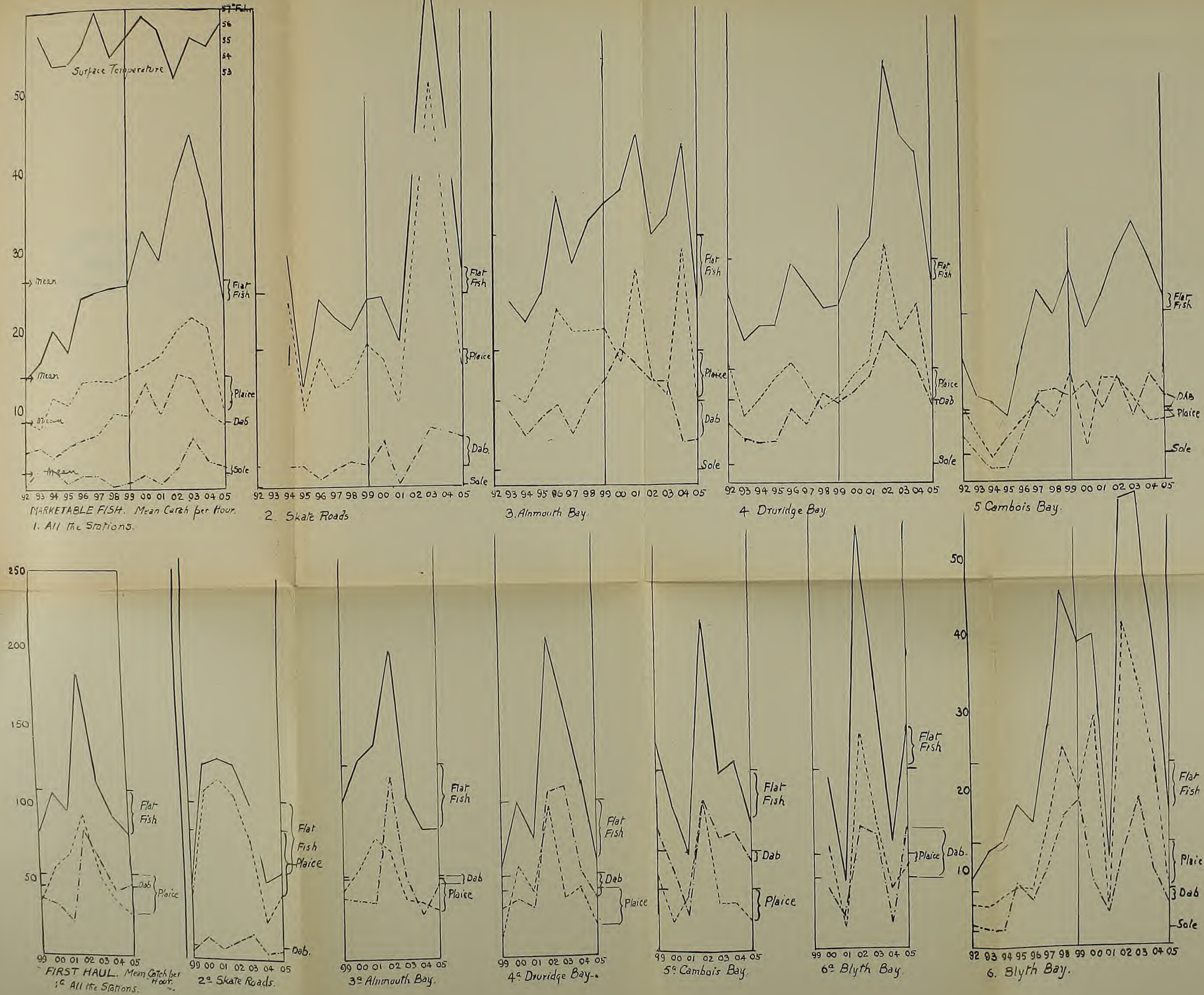


CHART II.

The mean catch per hour's trawling (*a*) of marketable flat fish, and (*b*) of the flat fish obtained at the first haul. The mean catch for the period is indicated by a short line on each side of each diagram.

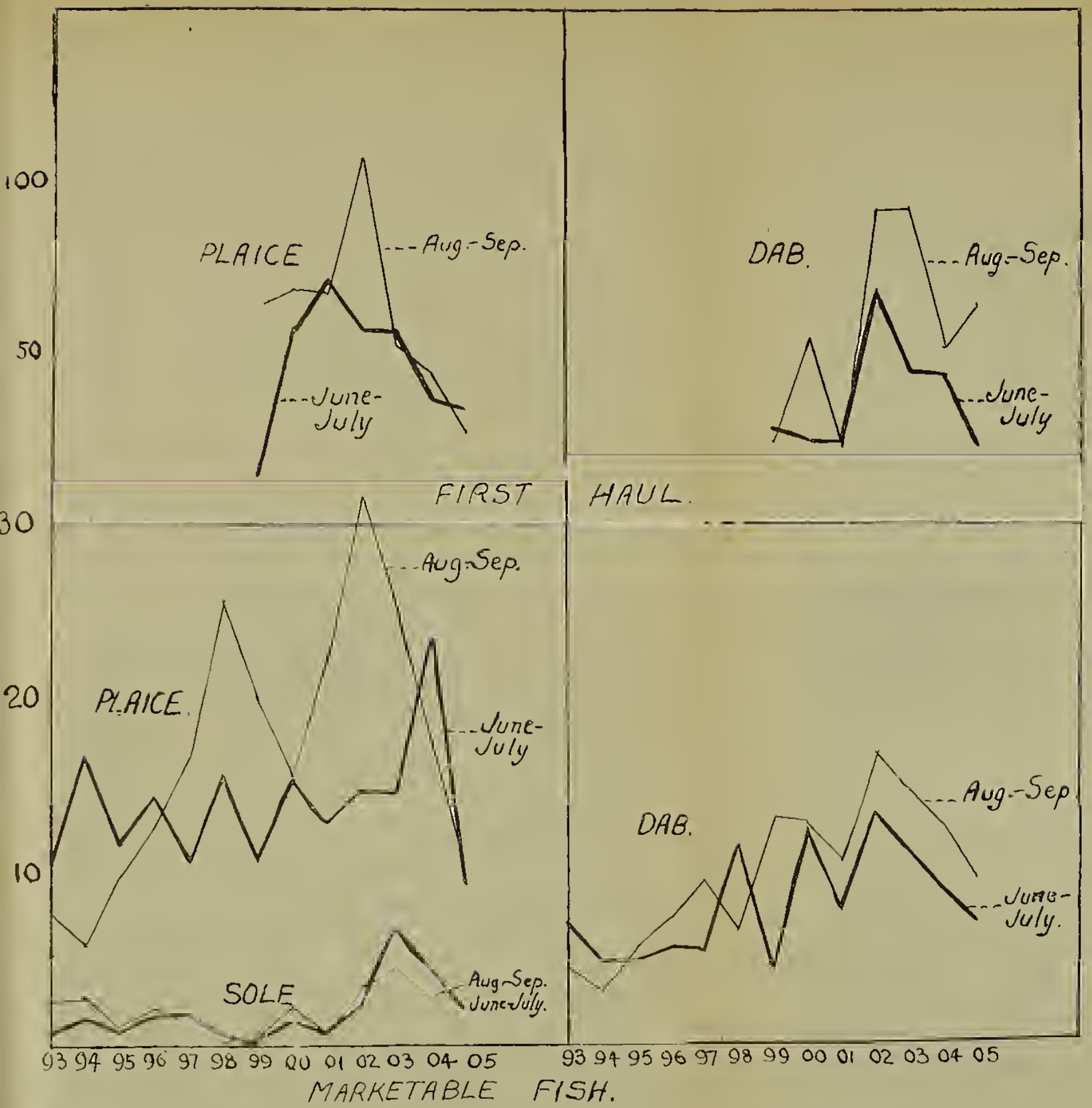
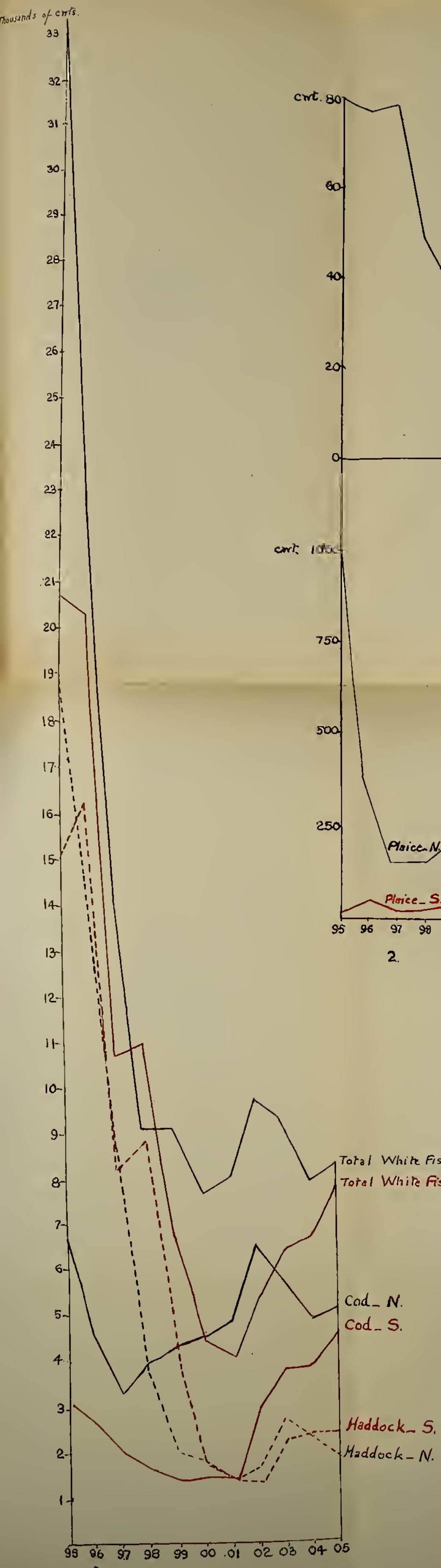
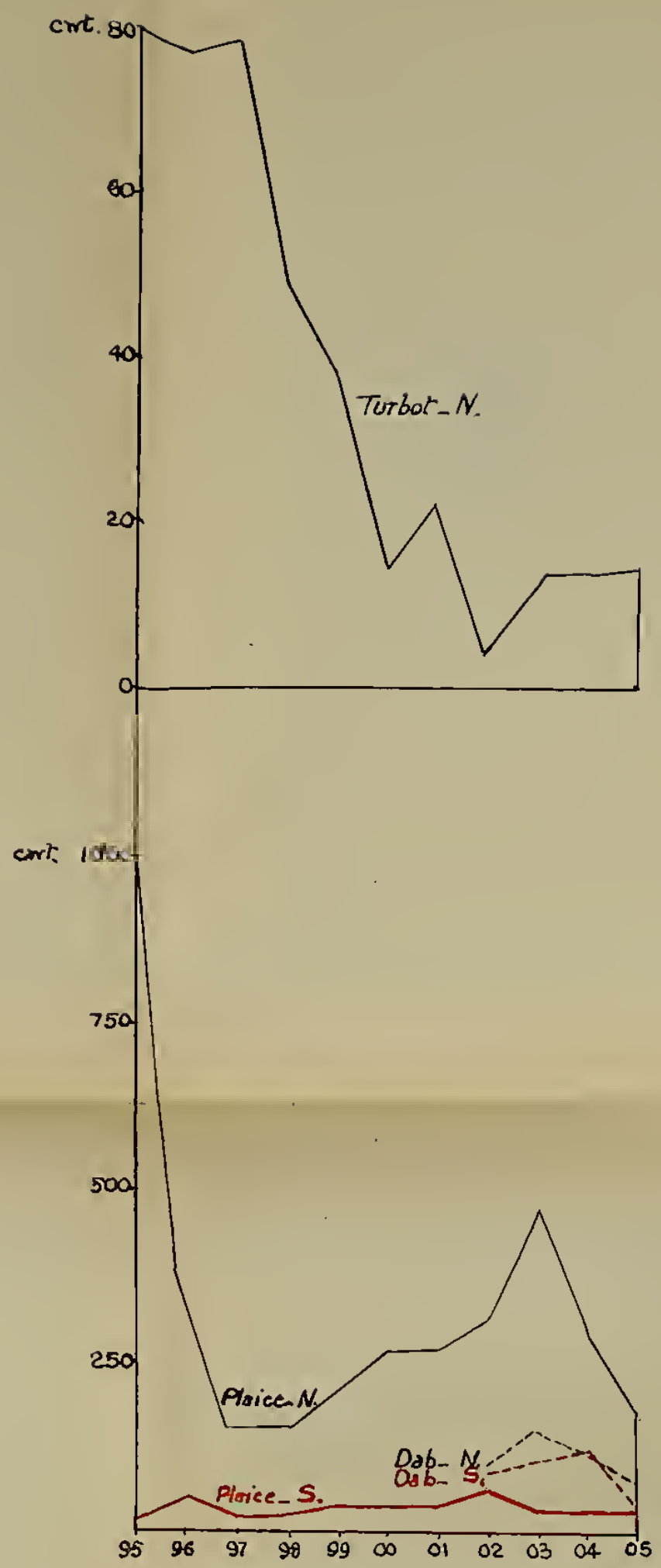


CHART III.

The catch per hour's trawling (*a*) during the months of June/July, and (*b*) during the months of Aug./Sept., at all the stations.





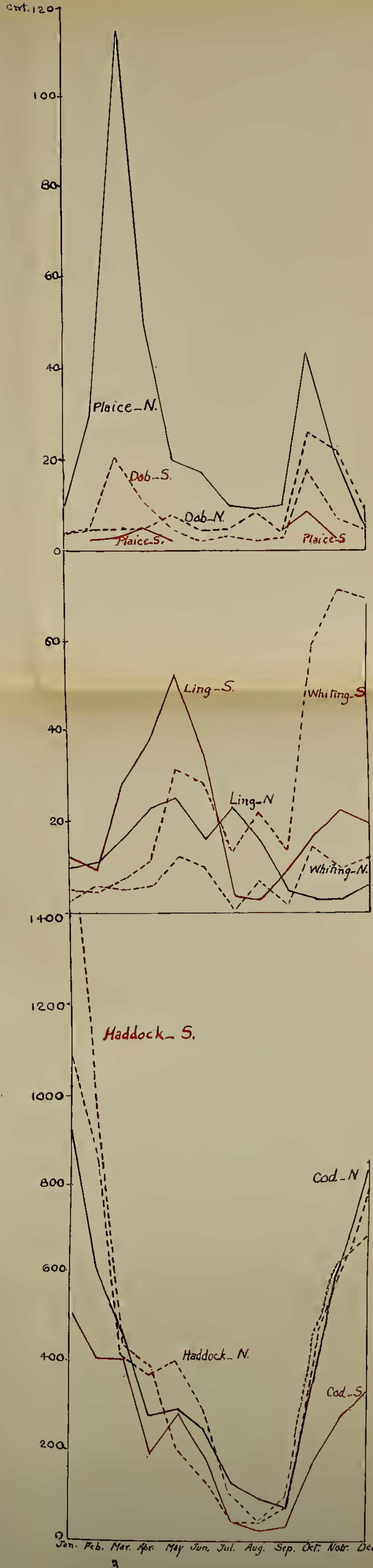
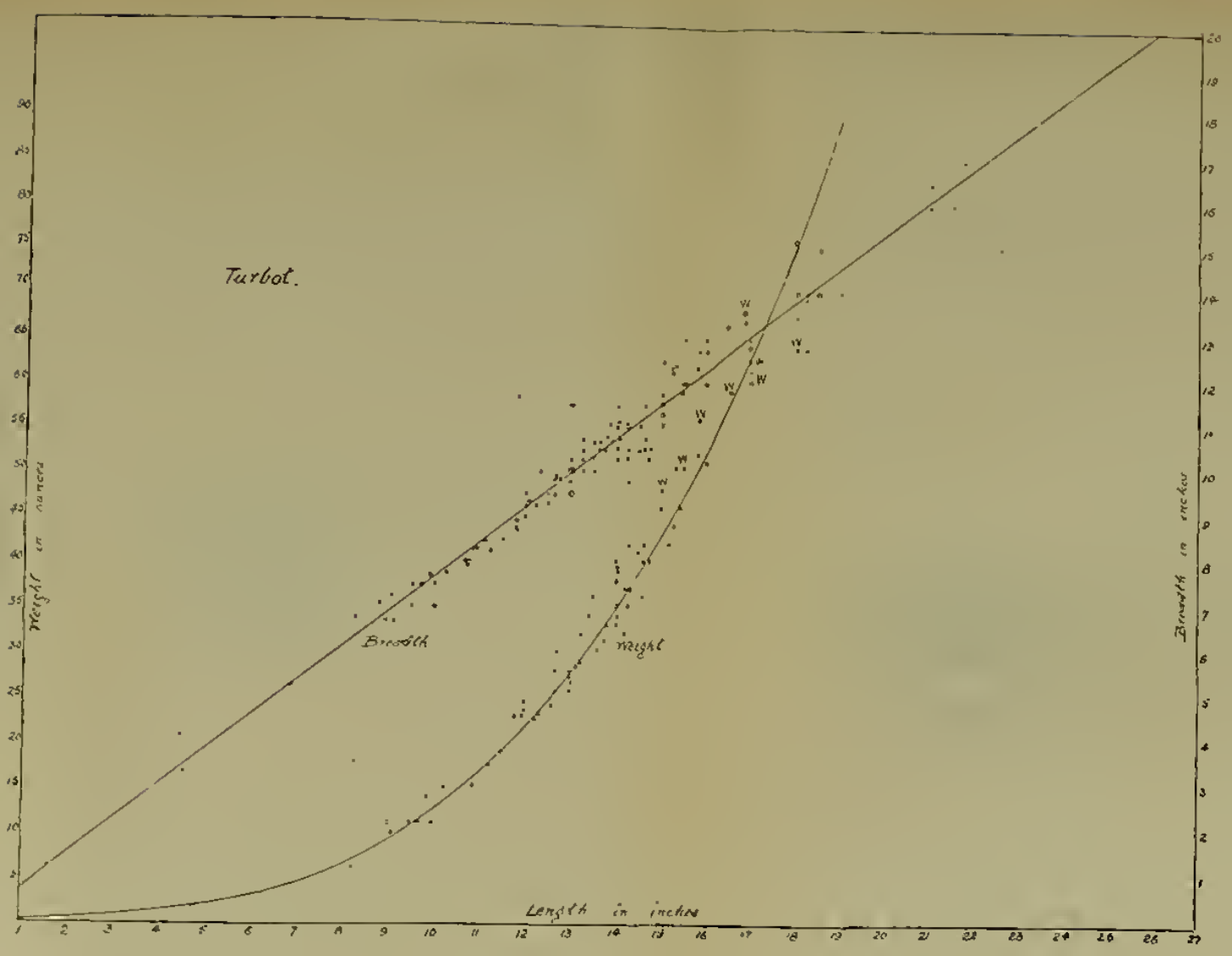
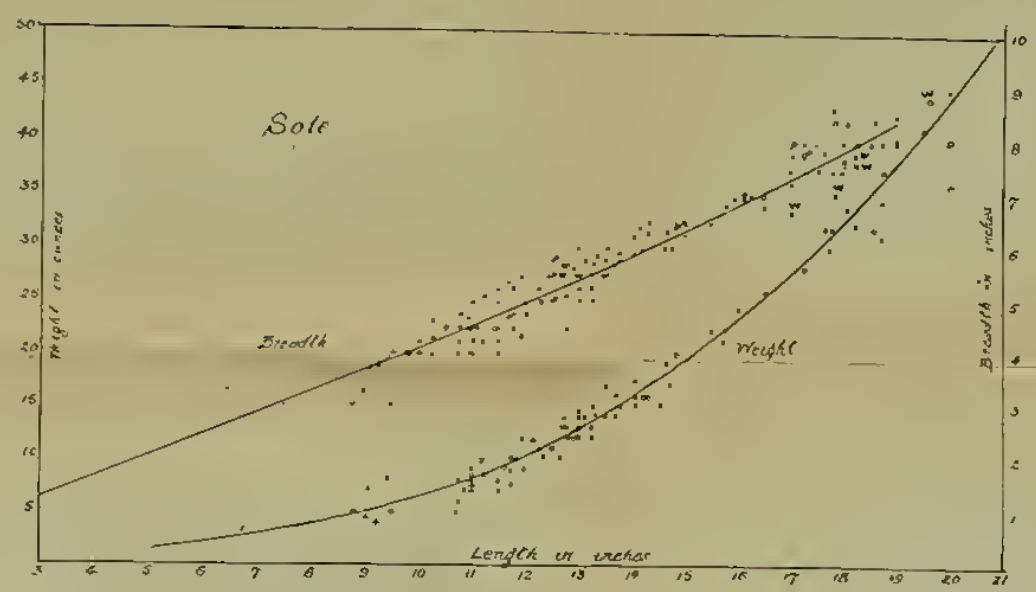


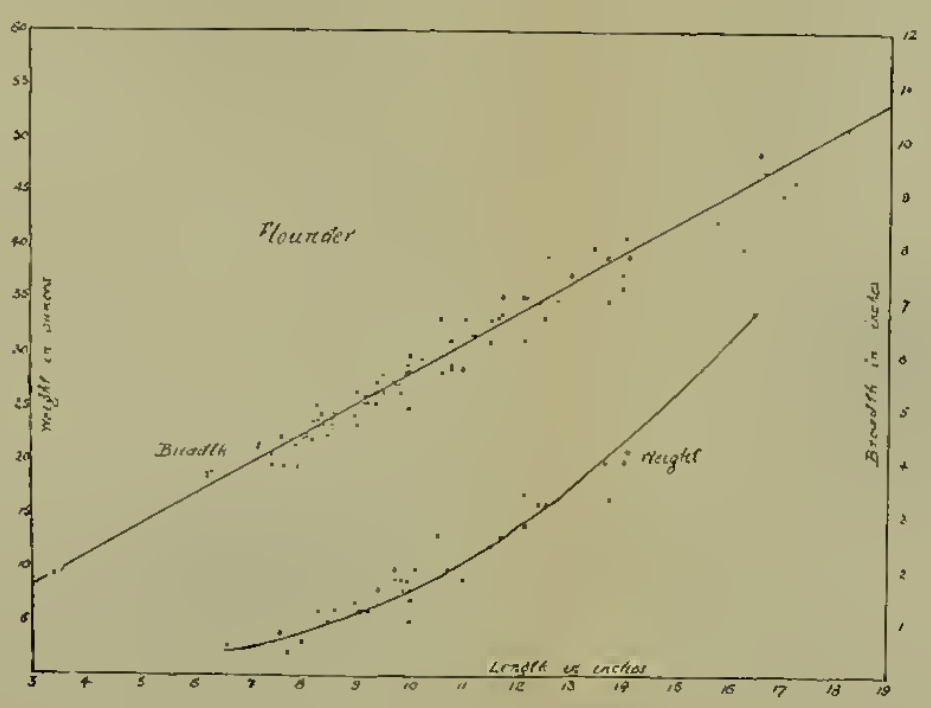
CHART V.

The Catches made by Fishermen in the Northern and Southern districts of Northumberland, excluding North Shields.

N (Northern)—Black.
S (Southern)—Red.







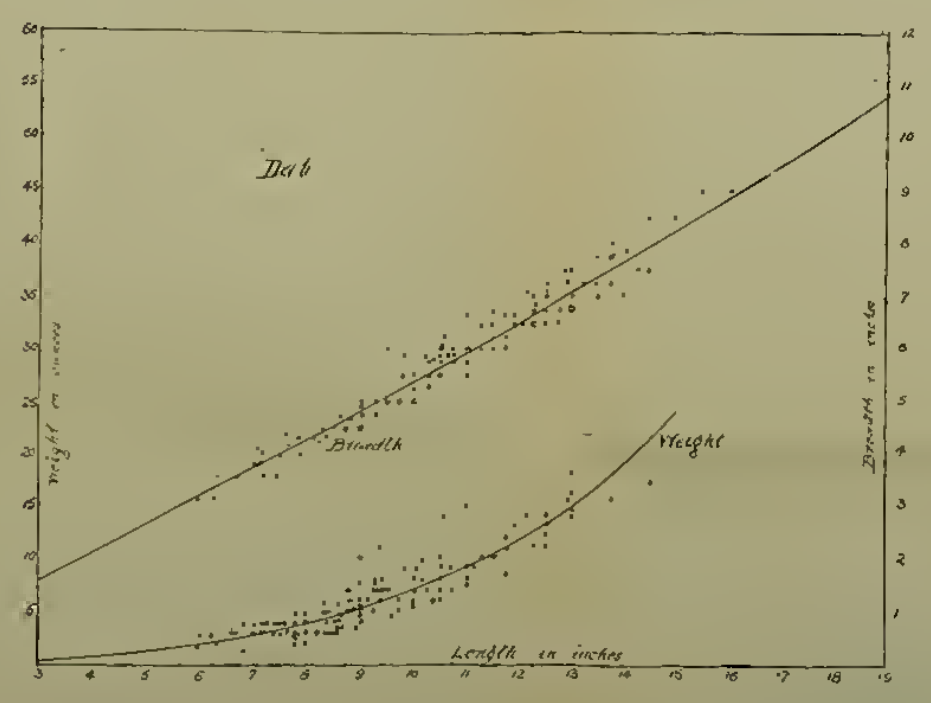


CHART IV.

Relation of Breadth and Weight to Length of—Dab, Flounder, Sole and Turbot.

THE CRAB AND LOBSTER FISHERIES OF NORTHUMBERLAND.

By A. MEEK.

I.—THE VALUE OF PROTECTION.

In continuation of the accounts given in previous reports, and the more complete paper in the report for last year, I beg now submit tables showing the catches of crabs and lobsters made in 05 by G. Faweus, Sea Houses, and by J. Douglas, Beadnell.

Attention may especially be drawn to the numbers of soft crabs the catches at Sea Houses during the months of August and ptember. The proportion of soft crabs in the latter month was 5 to 100 hard, or 73 per cent. of the total catch. Mr. Faweus ote with regard to his figures for September: "I had the crab pots three fleets, two on hard bottom and one on soft. If all the b pots had been on the smooth bottom, I could have doubled the mber of white crabs. I counted 28 white crabs in one crab pot the smooth bottom."

The attempt was made in the last report to contrast the rthumberland with the districts to the north and the south, since laws relating to crabs and lobsters are diffierent in all three. bring the evidence up to date the following figures for 1905 are w presented:—

	Numbers of Crabs.	Numbers of Lobsters.
Northumberland.—Northern District ...	948,273	21,025
,, Southern District ...	393,871	17,809
Total ...	1,342,144	38,834
North Eastern	2,222,819	35,795
Eyemouth	326,100	5,226

If these returns be compared with those given in the last report vill be seen that the general improvement, which has resulted ce the close time was imposed in 1896 in the North Eastern trict, is continued. The number this year is in fact the largest ich has been recorded during, at all events, the past 15 years.

A slight improvement has also taken place in the Northumberd district at least in the southern division (where practically no ıter fishing for crabs takes place), but the figures are much ow the average of the last ten years.

TABLE I.—CRABS.

TABLES SHOWING THE CATCHES OF CRABS AND LOBSTERS FOR 1905.
BY MR. J. DOUGLAS, BEADNELL.

	January.	February.	March.	April.	May.	Ju
Depth in Fathoms ...	28 ...	28 ...	20 ...	16 ...	10 ...	3 t
No. of Pots...	100 ...	100	150 ...	250 ..	250 ...	2
Dates.	Numbers.	Numbers.	Numbers.	Numbers.	Numbers.	Nun
1st ..	...	240	80	160	130	
2nd ...	...	60	160	...	108	
3rd ...	100	200	100	200	120	1
4th ...	160	100	180	238	100	
5th ...	...	...		180	112	2
6th ...	200	...	100	..	110	3
7th ...	...	200	60	200	..	
8th ...	...	100	80	330	100	4
9th .	300	160	100	...	21	6
10th ...		80	..	420	60	4
11th ..	200	80	100	186	20	.
12th ...	200		...	...	15	2
13th .	300	100	120	80	22	3
14th ...	...	240	100	360		4
15th ..	...	...	...	...	40	5
16th ..	...		200	...	28	..
17th ...	...	100	160	...	15	.
18th ...	300	160	80	...	20	..
19th ...	200	...	...	...	18	..
20th ...	100	...	200	180	100	..
21st ..	...	...		...	...	..
22nd ...	...	200	100	108	30	..
23rd ...	240	240	100	...	86	..
24th ...		..	...	300	100	..
25th ...	100	400	...	210	90	..
26th ...	...	...	...	212	86	..
27th ...	250	200	500	220	60	..
28th ...	...	200	100	110		..
29th ...	...	...	100	...	86	..
30th ...	200	..	60	...	30	..
31st ...	...	...	...	...	20	..
TOTALS ...	Days. Nos. 14 2850	Days. Nos. 18 3060	Days. Nos. 21 2780	Days. Nos. 17 3694	Days. Nos. 27 1727	Days. 12
Average per day ...	203	170	132	217	64	3

LOBSTERS.

	April.	May.	June.
Number of Days	17	27	13
Number of Pots...	250	250	250
Number of Lobsters	142	315	69
Number of Berried Lobsters ..	17	42	13
Number of Small	5	19	4

TABLE II.—CRABS.

By Mr. G. FAWCUS, Sea Houses.

Date. 1905.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Females.	Total Number of Hard.	Number of Soft.	Depth in Fathoms.
Feb. 13	80	60	109	...	169	6	26
14	80	105	128	...	233	9	,,
15	80	42	68	..	110	5	,,
17	80	38	52	...	90	4	,,
18	80	60	100	...	160	10	,,
22	80	108	168	...	276	3	,,
23	80	42	105	...	147	8	,,
25	80	102	143	1	246	6	,,
27	120	143	215	...	358	1	20 to 28
9 days	760	760	1088	1	1789	52	..
Average	per day	78	121	..	199	6	...
Mar. 1	120	94	160	...	254	2	20 to 28
4	120	63	84	...	147	2	,,
6	120	33	65	..	98	1	,,
8	120	24	68	...	92	3	,,
9	120	41	79	...	120	4	,,
13	120	36	81	...	117	2	,,
15	120	25	73	...	98	...	,,
18	120	18	28	...	46	3	,,
20	120	26	42	...	68	...	,,
27	136	28	44	...	72	2	4 to 26
29	136	30	45	...	75	3	,,
30	136	22	55	...	77	2	,,
31	136	18	60	...	78	3	,,
13 days	1624	458	884	...	1342	27	...
Average	per day	35	68	..	103	2	...
April 1	136	26	48	...	74	1	4 to 26
3	136	46	82	1	129	...	4 to 16
5	136	38	96	...	134	1	..
7	136	103	241	1	345	1	..
8	136	108	200	...	308	1	,,
10	136	132	215	1	348	...	4 to 12
11	136	20	71	1	92	...	,,
14	136	121	200	1	322	...	..
20	29	16	32	...	48	...	..
24	176	62	74	1	137	...	..
25	176	81	102	1	184	...	..
26	176	72	91	1	164	...	..
27	176	41	52	1	94	2	..
28	176	53	62	1	116	...	,,
29	176	31	51	1	83	1	..
15 days	2173	950	1617	11	2578	7	...
Average	per day	63	108	...	171	..	...

TABLE II.—Continued.—CRABS.

Date. 1905.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Females.	Total Number of Hard.	Number of Soft.	Depth in Fathoms.
May 1	176	60	79	1	140	2	4 to 12
2	176	72	93	1	166	...	,,
3	176	42	51	...	93	...	,,
4	176	65	81	2	148	...	,,
5	176	60	80	3	143	2	,,
6	176	58	88	1	147	...	,,
8	176	28	30	1	59	1	,,
9	176	32	35	2	69	..	,,
10	176	24	31	...	55	2	,,
11	176	18	21	1	40	...	,,
12	176	21	32	2	55	...	,,
13	176	24	22	1	47	...	,,
16	176	25	30	...	55	2	,,
17	176	20	21	1	42	..	,,
19	176	16	18	...	34	1	,,
20	176	47	52	1	100	2	,,
22	176	30	40	2	72	1	,,
23	176	60	70	3	133	4	,,
24	176	42	46	1	89	2	,,
25	176	55	64	...	119	4	,,
26	176	35	46	1	82	...	,,
27	176	31	40	...	71	2	,,
22 days	3872	865	1070	24	1959	25	...
Average	per day	39	49	1	89	1	...
June 12	72	48	53	2	103	...	8 to 16
13	72	36	41	1	78	...	,,
14	72	38	43	1	82	...	,,
15	72	46	56	3	105	...	,,
16	72	35	28	...	63	...	,,
19	72	61	72	1	134	...	,,
20	72	24	35	...	59	...	,,
21	72	62	70	1	133	...	,,
22	72	34	26	2	62	...	,,
23	72	40	42	1	83	...	,,
26	72	36	41	3	80	...	,,
27	72	45	61	...	106	...	,,
28	72	30	40	1	71	...	,,
29	72	44	50	2	96	...	,,
30	72	32	42	1	75	...	,,
15 days	1080	611	700	19	1330	...	...
Average	per day	41	47	1	89	...	...

TABLE II.—Continued.—CRABS.

Date. 1905.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Females.	Total Number of Hard.	Number of Soft.	Depth in Fathoms.
July 3	72	40	51	3	94	...	8 to 16
4	72	53	61	4	118	...	,,
5	72	31	42	1	74	...	,,
6	72	28	31	...	59	...	,,
7	72	35	41	2	78	...	,,
10	72	62	65	1	128	...	,,
11	72	60	70	2	132	...	,,
12	72	65	45	2	112	...	,,
13	72	71	62	1	134	...	,,
14	72	81	71	1	153	...	,,
15	72	83	65	1	149	...	,,
17	93	100	84	3	187	...	,,
18	93	92	81	2	175	...	,,
19	93	74	61	1	136	...	,,
20	93	78	71	2	151	...	,,
21	93	42	36	4	82	...	,,
22	93	51	42	...	93	...	,,
24	93	47	62	2	111	2	,,
25	93	40	50	1	91	1	,,
26	93	46	53	2	101	3	,,
27	93	44	60	1	102	2	,,
28	93	28	41	...	69	4	,,
29	93	31	53	2	86	3	,,
31	93	62	71	...	133	4	,,
24 days	2001	1341	1369	38	2748	19	...
Average	per day	56	57	1·5	114·5	1	...
Aug. 1	93	56	60	1	117	2	8 to 16
2	93	43	45	2	90	1	,,
3	93	51	62	1	114	5	,,
7	93	48	71	...	119	6	12 to 20
8	93	30	50	1	81	4	,,
9	93	25	60	...	85	7	,,
10	93	20	80	2	102	6	,,
11	93	16	60	...	76	5	,,
12	93	24	73	1	98	7	,,
14	93	14	82	...	96	4	,,
15	93	21	93	1	115	3	,,
16	93	16	71	...	87	8	,,
17	93	13	65	,,	78	4	,,
18	93	22	80	...	102	9	,,
21	93	18	70	...	88	5	,,
22	93	26	90	...	116	8	,,
23	93	12	62	...	74	5	,,
24	93	18	86	...	104	9	,,
25	93	24	90	...	114	10	,,
26	93	10	80	...	90	7	,,
28	93	14	60	...	74	18	,,
30	93	12	80	...	92	16	,,
22 days	2046	533	1570	9	2112	149	...
Average	per day	24	71	...	96	7	...

TABLE II.—Continued.—CRABS.

Date. 1905.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Females.	Total Number of Hard.	Number of Soft.	Depth in Fathoms.
Sept. 2	93	16	45	...	61	20	16
4	93	18	65	...	83	24	,,
5	93	24	83	...	107	26	,,
6	93	14	28	...	42	20	,,
9	93	20	60	...	80	60	,,
12	93	18	61	...	79	80	,,
14	93	10	74	...	84	300	,,
18	93	12	81	...	93	604	,,
19	93	25	94	...	119	400	,,
20	93	16	80	...	96	360	,,
21	93	23	64	...	87	420	,,
22	93	29	84	..	113	450	,,
12 days	1116	225	819	...	1044	2764	...
Average	per day	19	68	...	87	230	...

LOBSTERS.

Date. 1905.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Females.	Total Number	Depth in Fathoms.
Jan. 18	33	1	2	1	4	6
19	33	2	3	1	6	,,
20	33	1	1	...	2	,,
23	33	3	3	1	7	,,
24	33	6	7	1	14	,,
25	33	6	4	1	11	,,
26	33	1	...	...	1	,,
28	33	2	1	1	4	,,
31	33	3	2	...	5	,,
9 days	...	25	23	6	54	...
Feb. 2	33	2	1	1	4	6
3	33	1	...	...	1	,,
7	33	2	1	1	4	,,
8	33	4	3	...	7	,,
9	33	6	4	2	12	,,
10	33	7	5	3	15	,,
11	33*	5	3	2	10	,,
7 days	...	27	17	9	53	...
Mar. 27	136	1	1	...	2	4 to 26
29	136	...	2	...	2	,,
30	136	2	3	...	5	,,
31	136	3	4	...	7	,,
4 days	...	6	10	...	16	...

* These 33 pots were destroyed by a heavy sea.

TABLE II.—Continued.—LOBSTERS.

Date. 1905.	Number of Pots.	Number of Males.	Number of Females.	Number of Berried Females.	Total Number.	Depth in Fathoms.
April 1	136	4	5	2	11	4 to 26
3	136	2	3	...	5	4 to 16
5	136	4	5	...	9	,,
7	136	2	2	...	4	,,
8	136	2	1	.	3	,,
10	136	3	2	1	6	4 to 12
11	136	4	1	...	5	,,
14	136	1	3	1	5	,,
20	29	1	1	...	2	,,
21	176	3	2	...	5	,,
25	176	4	4	...	8	,,
26	176	3	6	...	9	,,
27	176	2	5	...	7	,,
28	176	4	1	...	5	,,
29	176	2	3	1	6	,,
15 days	...	41	44	5	90	...
May 1	176	1	...	...	1	4 to 12
2	176	4	2	1	7	,,
3	176	5	3	2	10	,,
4	176	2	4	...	6	,,
5	176	1	5	2	8	,,
6	176	4	5	1	10	,,
8	176	1	2	..	3	,,
9	177	4	3	1	8	,,
10	176	3	2	2	7	,,
11	176	1	1	1	3	,,
12	176	1	2	3	9	,,
13	176	4	4	2	10	,,
16	176	2	1	1	4	,,
17	176	2	2	...	4	,,
19	176	3	3	2	8	,,
20	176	1	2	1	4	,,
22	176	2	3	2	7	,,
23	176	1	2	...	3	,,
24	176	2	4	3	9	,,
25	176	8	12	4	24	,,
26	176	7	8	3	18	,,
27	176	4	6	3	13	,,
22 days	...	66	76	34	176	...
June 14	72	1	1	2	4	8 to 16
19	72	2	1	1	4	,,
28	72	5	4	2	11	,,
July 19	93	2	...	...	2	,,
21	93	1	...	...	1	,,
28	93	1	...	...	1	,,
6 days	...	12	6	5	23	...
Aug. 2	93	1	1	...	2	...

The numbers for the Eyemouth district show that the crab fishing in that region appears to be getting worse year by year.

A considerable increase has taken place during the years under consideration in the intensity of the crab fishing in the Northumberland region, and more than probably the same is true of the North Eastern. There is this difference between the two districts, however,—during the last ten years the winter fishing has been greatly developed in the northern half of the Northumberland region, whereas in the North Eastern area the close time has prevented fishing for crabs from the beginning of September to the end of January, or restricted it during that time to occasional attempts to fish in extra-territoral waters. If the general factors of the case be therefore that the catching power has increased in the two districts along parallel lines, and that in the one restricted, and in the other unrestricted fishing has been done in the last ten years the experiences of the fishermen resolve themselves into a scientific experiment, the result of which is that the restricted has gradually improved and the unrestricted region has deteriorated.

The preceding tables and those which were given in the last report show that the modern winter fishing for crabs is done during the main casting season, if the term be taken to include also the period during which the crabs are relatively soft or "white," and that a large number of soft crabs are caught to get those which are fit to send to market. It has also to be said that the many complaints which have been made during that season by the recipients of the crabs in the various markets indicate that those sent are not always even "fit." When they are "fit" they are, as was stated in the last report, usually females which are about to spawn. It would appear from the results of the migration experiments that these females have migrated into the district from the south. In both cases, however, the fishing must be considered destructive, and that it is destructive is evident from the difference in the results in the two divisions of the Northumberland region. It has already been said that the winter fishing has been particularly developed in the northern part of the district, and reference to the last report will show that the crab fishing in that area has pretty steadily decreased since 1898, while in the southern district it has slightly improved.

There is only one possible inference from these considerations, and it is, that the main population being stationary, the hardening

males alone migrating from the district, a byelaw such as that ich has been made by the North Eastern Committee is capable of iproving the crab fishery.

Such a contention is liable, as has been stated in previous ports, to the criticism that the protection is likely to be considerly minimised, if not made entirely useless, from the destruction soft crabs by trawlers fishing in the region—generally 3 to 6 les from the shore—where the general adult population of crabs igrates in the winter. There is the evidence of the above results show, however, that the destruction by trawlers is not so great as render such protection useless. The consideration raises the estion, however, whether it would be better to attempt to protect crabs from this form of destruction, or to do it by such regution of the inshore fisheries as that now in force in the North stern district, or if both methods are necessary.

At present, with international law as it is with reference to terririal waters, there are or appear to be grave difficulties in the way attempting further regulation of the trawl fishing, although we ve the example of the Scottish Fishery Board with regard to the ray Firth and the Firth of Clyde. The amount of the destruction can only be inferred from the answers to enquiries addressed trawl fishermen, and the information is so contradictory that it impossible to make very much of it. It is granted that a certain iount of destruction does take place, and that is about all that can said about the question at the moment.

But whether it be necessary or not to protect the crab fishing m such an extraneous method of destruction, the problem disssed above is not affected in the least by this further factor, for it not be assumed that the destruction is liable to be greater in one ion more than another. Nor can it be said that the reasons ich have been adduced in favour of protection in a case where a at amount of destruction is likely to take place by the ordinary thod of fishing, lose in force, if it can be shown that such protion has produced benefit, and that where it has not been given fishery has suffered.

Again in the case of lobsters, the berried females of which are tected during the months when they are liable to be caught most nerously in the Northumberland region, and not at all in the er two districts, the results also point to the advantages of protion. There has been a general decrease in the catches for 1905, it is evident that the leading position assumed for the first time t year by Northumberland is more than maintained.

Legislation is certainly not to be sought unless when it is necessary, but it is the only kind of thing that usually occurs to us when complaints are made of a decline in any branch of our fisheries. In some cases it may be confessed that mistakes have been made. But fishermen themselves recognise the benefits to be derived from protection which is guided by a common sense attempt to improve the fisheries. The common sense of the enactments it is plain must arise from a clear scientific presentation of the facts for as long a period as possible. We certainly do not know all we want to know with regard to crabs and especially with regard to lobsters, but we know enough to say with confidence that a close time for crabs during the casting season (as defined above), when the advent of that season is accurately determined for each district, is a fair and reasonable approach from the legislative side; and that, as was pointed out last year, if further improvement be sought in the case of the lobster fishery, it must be through the berried female.

The new laboratory at Cullercoats will enable us to make experiments in the rearing of lobster fry. It may be mentioned also that Ald. Dent made an experiment to determine whether the floating box system would answer at Blyth, but the box was not ready in time to get a satisfactory berried female of last season.

I may further take this opportunity of stating with reference to the question raised by Dr. Masterman in the Report of Proceedings under Acts relating to Sea Fisheries for 1904, p. xxxii., that our Fishery Officers have been instructed practically as to the difference between unberried females and berried females which have been artifically stripped, and have been provided with a lens each for the purpose. An external examination is not always satisfactory, unless the stripping has been hurriedly done, and one or more of the "berries" have been overlooked. But I cannot remember a case of the fishery officers making a mistake when they took possession of lobsters which they concluded had been stripped, from an inspection of the condition of the setæ of the swimmerets, the general colour of the ventral abdominal region, and the state of the torn membranes of the eggs where they were attached to the setæ. These lobsters were always submitted to me, and a further more careful scrutiny of the external evidences, and an examination of the condition of the ovary in each case was found sufficient to settle the matter. It was easy by this means, that is to say, from the size and colour of the ovary, and the size of the ova, to determine whether the specimen in question was a berried female or not. At

seasons, excepting the hatching one, this was found to be entirely isfactory, but during the hatching season it was necessary as well determine whether the lobster was one which had recently tched. And this it is plain is a matter of considerable difficulty, en every possible indication must be taken into account. As a tter of fact, however, the difficulty was not found to be that of ntifying the stripped lobster, but of proving in a satisfactory nner where the lobster had been caught as is required as the law present stands.

II.—THE MIGRATIONS OF CRABS.

The report for 1903 gave the results of the experiments which re made at my request by Mr. Douglas, Beadnell, and these owed that the female crabs, which were in the process of becoming d after a recent autumn ecdysis, migrated northwards. Two ales which were marked and liberated on October 25, 1902, were aptured the following year, one on March 28th, in Goswick Bay, r 12 miles north of Beadnell, and the other on July 6th, at Port-len, Kincardineshire, which is about 80 miles north of Beadnell. It was determined to repeat the experiment, and to have the rking done as early in the casting season as possible, so that the bs would be liberated at the beginning of the winter migration. e following tables give the results of the experiments made at adnell, 1904-5, and at Beadnell and other places on the Northum-land coast, in 1905-6.

The Beadnell experiments of 1904-5 offer ample confirmation of northward migration of the females, which have "cast" and have eived their supplies of sperms for fertilising the ova at the next wning season. All the females recovered (four*), were caught be-en Burnmouth and Dunbar. The males on the other hand were obtained in the Beadnell district, and that they do not appear to grate is shown by the example which was liberated on January 6, 03, at Beadnell, and which was recaptured on January 13, 1906, at Beadnell.

The results of the 1905-6 experiments are still incomplete, and e of the crabs have so far been obtained at any great distance n the place of liberation.

* Since the above was written several females have been returned from different places on the east coast of Scotland.

THE MIGRATION OF CRABS,

BEADNELL, 1903-1904.

LIBERATED.			CAPTURED.			
Date.	Number (m. & f.)	Place.	No. of Label.	Date.	Sex.	Place and Migration.
1903.				1906.		
Jan. 6 ..	28	Beach	137	Jan. 13	M	4 miles N E. of Beadnell (maki captures altogether of the 28)
1904.				1905.		
Oct. 15 ..	100	....	218	May 9	F	Innerwick, in 7 to 8 fathoms, 4 Dunbar; migration, 45 miles
			225	ca. Feb. 22	F	Cockburnspath* (16·5 cm.); m 35 miles north.
			270	March 8	M	4 miles E.N.E. of Beadnell.
			286	ca. Apr. 14	M	Sea Houses** (17 cm.); migr miles N.E.
				1904.		
			290	Dec. 9	M	4 miles N E. of Beadnell
1904.				1905.		
Oct. 22 ..	96	Beach	110	Feb. 3	F	1 mile off St. Abb's; migration, north.
			127	,, 8	F	1½ miles off Burnmouth, in 25 f migration, 25 miles north.
				1904.		
			131	Nov. 28	M	4 miles N.E of Beadnell.
			161	,, 20	M	2 ,, E.N.E. ,,
			167	,, 17	M	4 ,, E.N.E. ,,
			178	,, 5	M	1 ,, E. ,,
				1905.		
			181	Jan. 25	M	5 ,, E.N.E ,,
			184	April 7	M	4 ,, N.E. ,,
				1904.		
			186	Nov. 12	M	1½ ,, N.E. ,,
Total .	196		Total... 14			

* Sent to Lowestoft Laboratory by J. W. Webster, Sheffield, who wrote: —"This crab has come fr Cockburnspath, and I thought it my duty to forward it to you, as per F.T.G."

** Received in a barrel of crabs from Sea Houses by Charles Barber, Darlington.

BEADNELL, 1905.

LIBERATED.			RECAPTURED.			
Date.	Number Lib'rtd.	Place	No. of Label.	Date	Sex.	Place and Migration.
1905.				1905.		
Oct 28...	100	Beach	303	Nov. 8	M	4 miles N E. of Beadnell.
			312	,, 28	F	4 ,, ,, ,,
	(40 M 60 F)			1906.		
			326	Jan. 22	M	4 miles E. of Beadnell
	4		331	,, 20	F	4 miles N.E. of Beadnell.
				1905.		
			345	Dec. 8	F	4 ,, ,, ,,
			348	,, 4	F	4 ,, ,, ,,
			353	Nov. 25	F	4 ,, ,, ,,
				1906.		
			a 353	Jan. 23	F	4 ,, ,, ,,
				1905.		
			354	Dec. 18	F	4 ,, ,, ,,
			374	Nov. 21	F	4 ,, ,, ,,
				1906.		
			a 374	Jan. 5	F	4 ,, ,, ,,
				1905.		
			375	Nov. 21	F	4 ,, ,, ,,
			381	,, 21	F	4 ,, ,, ,,
			391	Dec. 15	F	4 ,, ,, ,,

a Was liberated a second time on the date of the first recapture.

MIGRATION OF CRABS (*continued.*)

CRASTER, 1905.

LIBERATED		RECAPTURED.			
ıber rtd.	Place.	No. of Label.	Date.	Sex	Place and Migration.
6	6 miles E.S.E. of Craster				
1	6 miles E. by S. of ,,				
			1906.		
0	4 miles S.E. of Craster	839	Jan. 15	...	5 miles E. of Dunstanborough Castle; migration, 5½ miles N.N.E.
5	4 miles E. by S. of ,, except 860 and 861 1½ miles E. of Craster)		1905.		
		862	Nov. 1	M	2 miles N.E. of place of liberation in 4 days.
			1906.		
5	1½ miles E.S.E. of Craster	874	Feb. 14	M	5 miles E. of Craster; migration 3½ miles S.E. "Very soft when liberated; now nearly hard."
		880	Feb. 5	F	2 miles S.E. by S. of Craster. "Soft when liberated, now hard."
			1905		
		892	Dec. 7	F	5 miles S.E. of Beadnell; migration, 5 miles N.E.

HAUXLEY, 1905.

0	Hauxley Haven	...	...	...	Two were reported as being recaptured and returned, the numbers not being noted; one was said to have travelled fully 1¼ miles in 3 days.
0	Do.	...	...	...	
0	Do.	...	.	...	

NEWBIGGIN, 1905.

			1905.		
M	Low water mark, Newbiggin	791	Nov. 4	M	2½ miles E.N.E. in over 20 fathoms—"hard."
F					
M	Ditto				
F					
M	Ditto				
F					
M	Ditto				
F					

SEA HOUSES, 1905.

			1906.		
	300 yards off the Harbour	592	Mar 3	F	Longstone, bearing S.S.E., in 30 fms.; migration, 7 miles N.E.
			1905.		
		598	Dec. 2	F	3 miles E. of Sea Houses.
			1905.		
	2 miles E. of Sea House	579	Dec. 13	?	1 mile W.N.W. of place of liberation.
	300 yards off the Harbour				
	Ditto				
	Ditto				

NOTES ON NORTHUMBRIAN TREMATODES.

By M. V. LEBOUR, B.Sc.

Whilst investigating the mussel beds of Northumberland (a detailed account of which will be published hereafter) I found some interesting trematodes both in the mussels themselves and the other Mollusca of the beds. A few notes on these may not be out of place here.

An encysted trematode occurs in the foot of the mussel, *Mytilus edulis*, from Budle. This is the worm described by me from the foot of the cockle (Northumberland Fisheries Report for 1904). It was also later described more fully by Mr. Nicoll of St. Andrews (Ann. and Mag. Nat. Hist., Jan. 1906) from the foot of the mussel, cockle and *Mactra stultorum*. I have also found it in the foot of *Mya arenaria* and *Macoma balthica*. Mr. Nicoll has found what he believes to be the adult stage in the Oyster Catcher and the Herring Gull and he has given it the name of *Echinostomum secundum* (Ann. and Mag. Nat. Hist., June, 1906). The encysted stage is more abundant in the mussel than in the cockle, nearly every specimen being infected. Besides the foot it is sometimes to be found in the tissue forming the "floor" of the liver and, rarely, in the liver itself. In the cockle it occurs in the foot and in the mantle edge. It is easily seen from the outside in the cockle, showing as small tubercles all over the foot. In the mussel, however, nothing peculiar is visible outside. I have found what I believe to be the previous host of this worm in the common periwinkle *Littorina littorea* (see Plate I. Fig. 1.) It occurred in one specimen of this mollusc out of two examined in March, 1906, and in only one specimen out of 19[illegible] examined in June. The liver in these two periwinkles was full of the redia stage of a trematode and these rediæ were full of tailed cercariæ of various sizes. The cercariæ agreed in many ways with the encysted form in the foot of the mussel and cockle. The rediæ are a brilliant orange and the colourless transparent cercariæ show up against this bright background so that their shape is clearly seen. The liver of the periwinkle is orange because it is packed full of these rediæ, so it is easy to see whether the specimen is infected or not. Each full-grown redia is about 1 mm. long, is of an elongated

rm with an anterior sucker having a projecting rim and leading ito a sac-like intestine which is coloured a bright red and yellow. he young redia is not so distinctly coloured and has a collar and ·ooves across the anterior end of its body. The full-grown rediæ ntain the cercariæ in different stages. At first no structure can e made out, the cercaria is merely a granular mass; next it has a il and its head becomes somewhat heart-shaped; then the ckers are formed and the pharynx, intestine and excretory organs gin to appear. These agree in size and position with the similar gans in the encysted form and the size is about the same, 0·7 mm. ng. The armature is not developed until the cercaria is nearly ll-grown; the spines round the head first appear and then the nall spines which surround the body, except at the posterior d. The head spines are 29 in number, agreeing with the encysted rm, and their arrangement is also the same. The liberated cer- aria is very active and contractile, lashing its tail continually, which gan, however, comes off at the slightest touch. The excretory stem is plainly seen, and in living specimens a posterior excretory lb which soon disappears after death. I think this is the *Cercaria roxima* of M. Ch. Lespés (Ann. des Sci. Nat. Ser. 4, Tom 7, 1857) hich in many ways agrees with my specimens. His, probably, ere not so far advanced, and the spines were not developed. He und it in the liver of *Littorina littorea*, only one out of 200 which examined being infected. He describes it, however, as having e suckers almost equal in size and he found small spines in the al sucker, which I have not been able to make out in my specimens, d in these the posterior sucker is decidedly the larger of the two. he bilobed intestine in his figure is much more plainly seen than any of those I found.

The tailed cercaria presumably leaves the host, swims in the ater and is carried by the current into the mussel or cockle, bores s way into the foot, settles down and encysts. The mussel or ckle is then eaten by a bird, Oyster Catcher or Herring Gull (both which are known to eat mussels) and in the intestine develops to the adult worm. I hope soon to be able to make some ex- riments as to the infection of the mussel with the worms from e periwinkle.

Assuming the forms in the periwinkle, mussel, and cockle, and e above mentioned birds to be the same species, we have the llowing life history :—

ECHINOSTOMUM SECUNDUM, NICOLL.

First Host.	Second Host.	Final Host.
Littorina littorea.	*Mytilus edulis.*	Oyster Catcher (*Haematopus ostralegus.*)
	Cardium edule.	
	Mactra stultorum.	Herring Gull (*Larus argentatus.*)
	Mya arenaria.	
	Macoma balthica.	

Another trematode from the Budle Mussels occurs in the liver (see Plate I., fig. II.) It is not so plentiful as those in the foot but is often to be found encysted beween the lobes of the liver. By carefully pressing it out of the cyst it is seen to be elongated, length 0·46 mm., and its body is covered with short spines. Not much structure can be made out, the granular excretory system being most noticeable when the worm is still in the cyst, but these quickly disappear. There is an anterior oral and a posterior median sucker, the former leading to a scarcely perceptible pharynx. Two clear canals are faintly visible down each side which communicate together anteriorly; this is perhaps the excretory system devoid of its granules. The worm appears to be a species of Distomum, and this stage apparently has not been described.

The cockle, *Cardium edule*, of Budle besides the encysted trematode in the foot, contains three more species. One of these is the sporocyst and cercaria stage of the 'pearl trematode' which is the cause of the pearls in the mussel. Another sporocyst in the liver was described by me in last year's report, and also later by Mr. Nicoll (*op. cit.*). This has evidently nothing to do with those in the foot. A third species of sporocyst occurred in one cockle in March (see Plate II., fig. III.); some hundreds were present in the liver. They were very contractile and of various shapes, had no eyes, and were not ciliated. Each contained four or five round bodies which were probably far advanced germ balls.

In one specimen out of 190 of *Littorina littorea* from Budle examined the kidney was full of the cercariæ of a second species. It occurred in great abundance in long sporocysts about 1 mm. long (see Plate II., fig. IV.) This appears to be the *Cercaria linearis* of Lespés (*op. cit.*) which he found in the kidney of *Littorina littorea*.

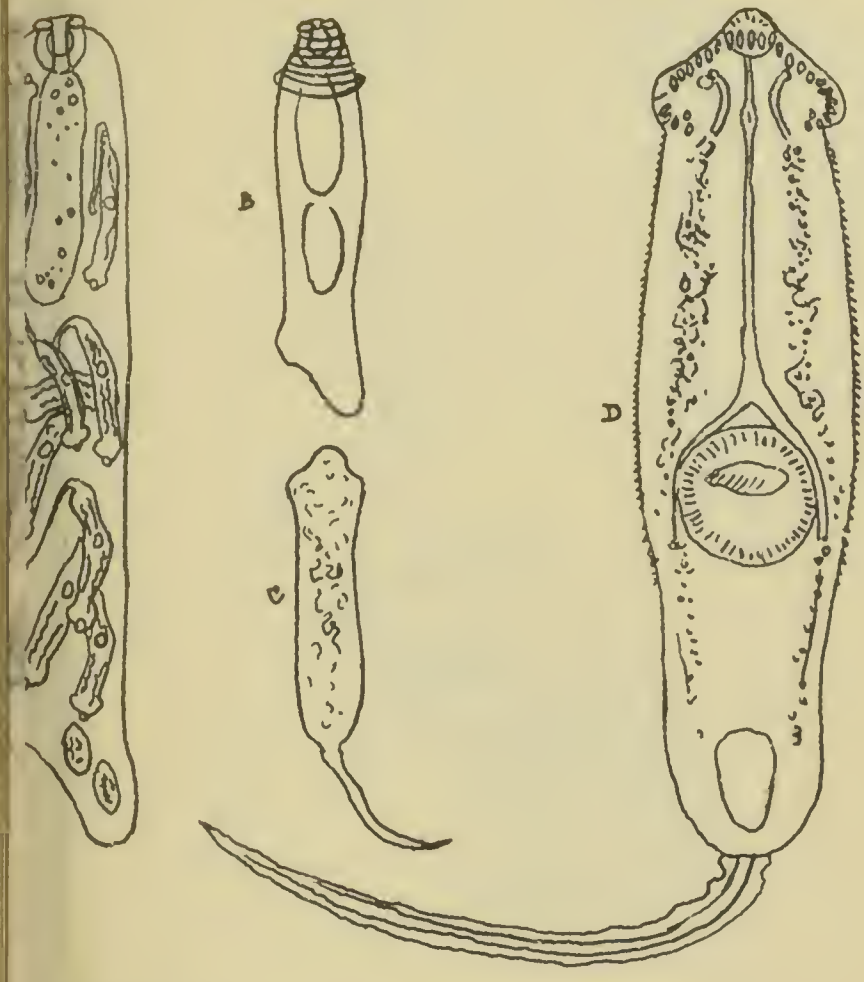
, has a very short and broad tail, its oral and ventral suckers are lmost of the same size—the former having one large spine at its nterior end—and there are four ducts by this sucker belonging) the glands or 'stacheldrüsen,' the salivary apparatus of Lespés. could not see the four large cells described by Lespés belonging) these. At the posterior end just above the tail there is a large ecretory sac.

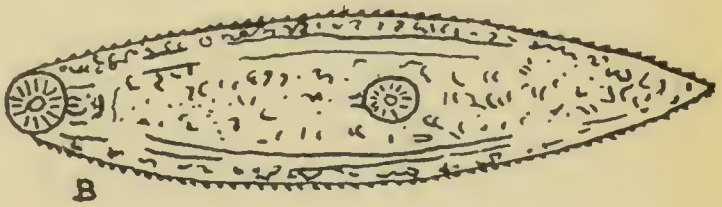
A specimen of *Littorina rudis* from Holy Island opposite the assel scaup contained sporocysts of a trematode in grape-like asses in the liver. These were full of tail-less cercariæ (see Plate I., fig V.) This was in the beginning of May. The pale-yellow ound sporocysts are each about 1 mm. in diameter and are crowded ith numerous cercariæ curiously doubled up. The way these lie the sporocysts is worth noting, the head end being nearly always ubled in, giving the worm the appearance of a pouch. When exended the cercaria measures 0.25 mm. in length, it is pear shaped, d the body is covered with small spines for the first two thirds of its length. The oral sucker leads into an œsophagus which in rn leads into a pharynx from which a long narrow intestine runs own for not quite two thirds of the length of the body and bifurates into two short lobes. The ventral sucker is just between these. his cercaria is evidently the same species as the encysted form hich McIntosh found in the common green crab, *Carcinus mœnas* Journal of Microscopical Science, 1865). Brandes (Archiv f. atürgesch., 1888, Bd. I.) regarded this as the encysted form of *istomum claviforme* which he describes from the Dunlin. Mr. icoll (*op. cit.*) is of the opinion that it is just as likely to be the ncysted form of *Distomum similis*, Jägerskiöld, which species he has iscovered in the Herring Gull at St. Andrews. This bird has been nown to eat green crabs, and it is therefore a more likely host for e worm than the Dunlin. The Herring Gull is very common at oly Island and is constantly to be seen flying about over the scaup. nother trematode was found in the liver of a specimen of *Buccinum ndatum* from the scaup. The liver was full of long yellowish sporo-sts containing tailed cercariæ (see Plate III., fig. VI.) The cer-ria is colourless and has two eyes rather far apart, one on each de of the pharynx. It is extremely contractile and constantly ters its shape. It bears a large oral sucker leading into a con-picuous lipped pharynx by an œsophagus which is sometimes in-sible owing to the contractions of the animal. A large median cker almost the same size as the oral sucker occurs in the centre,

and the narrow intestine leading from the pharynx branches here into two lobes; a large pear-shaped excretory sac is conspicuous. The cuticle is covered with small spines which are particularly marked near the head end, and as they are arranged in rows give this part of the body a transversely striated appearance. A thin tail occurs but it is so easily separated from the worm that the latter is more often seen without it. Villot (Ann. des Sci. Nat., Ser. 6, Zool. Tom. VIII., 1878) describes a cercaria, *C. migocera*, very like this, but differing slightly in the tail. This he found occurring in sporocysts in *Scrobicularia tenuis*. If it be the same species it is curious that it should occur both in a gasteropod and a lamellibranch.

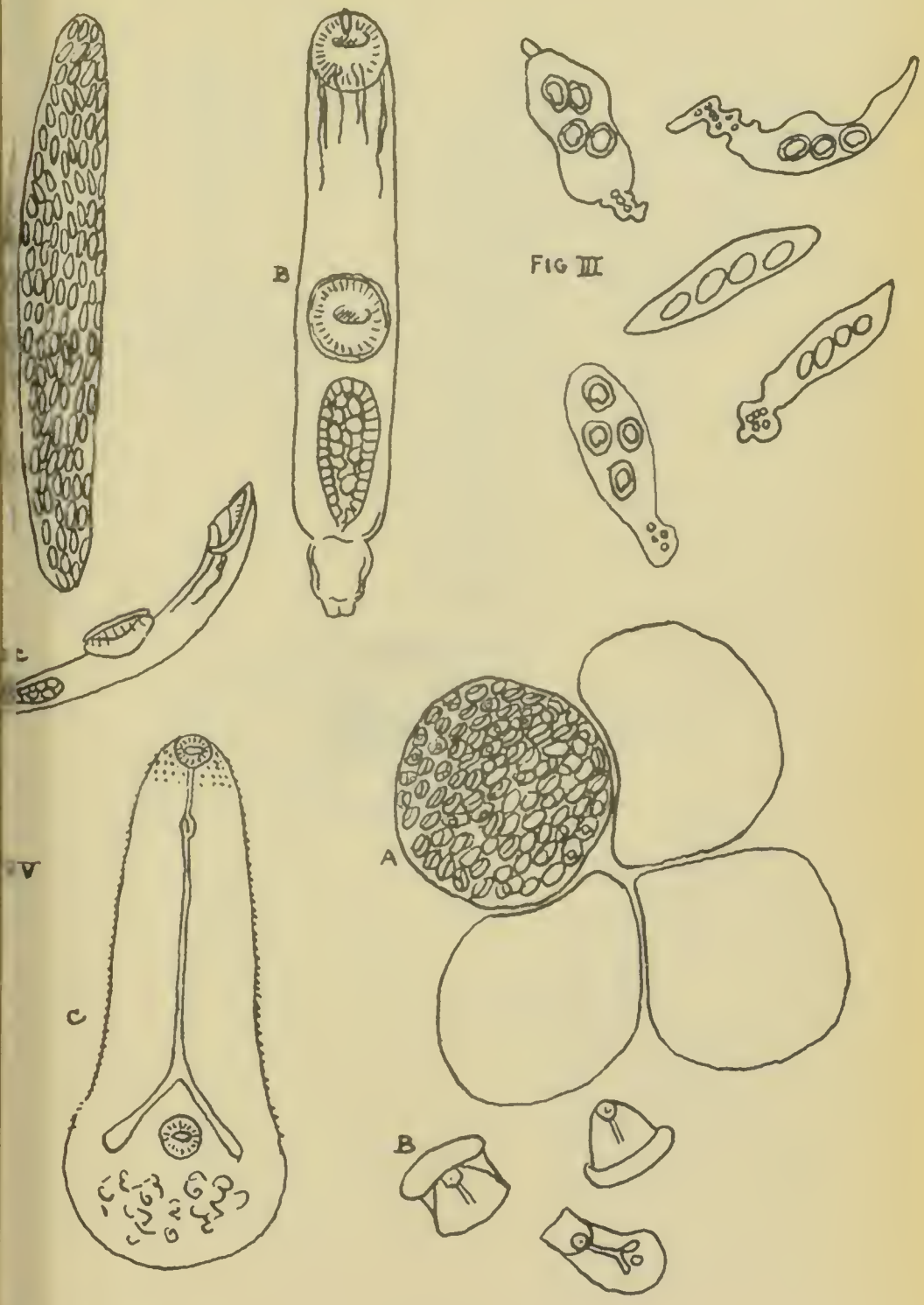
In *Macoma balthica* from opposite the scaup a sporocyst occurred which was pale yellow, had two eyes, and was ciliated (see Plate III., fig. VII.) It moved fast and had nothing but small granules in its body. In the intestine some simple yellow sporocysts were found, without eyes, not ciliated, and with only small granules inside. These were also present in *Macoma balthica* from Budle.

In conclusion I might mention a cercaria which occurred in *Tellina tenuis* and *Donax vittatus* although these were not from any mussel bed but from the Alnmouth sands. It is very transparent, oval, with a conspicuous curved excretory apparatus (see Plate III., fig. VII.) A large oral sucker leads into an intestine with two very broad and short lobes, and there is a large median sucker. The body is covered with spines and a very small tail occurs. This is probably the species allied to *Brachycœlium luteum* described by Giard (Comptes rendus hebdomadaires des séances de la Soc. de Biologie, 1897). He thinks it may possibly be the same species as *B. luteum* as it only differs from it in the relative size of the suckers. The tail in my specimens is evidently not fully developed.





ATE I



ATE II

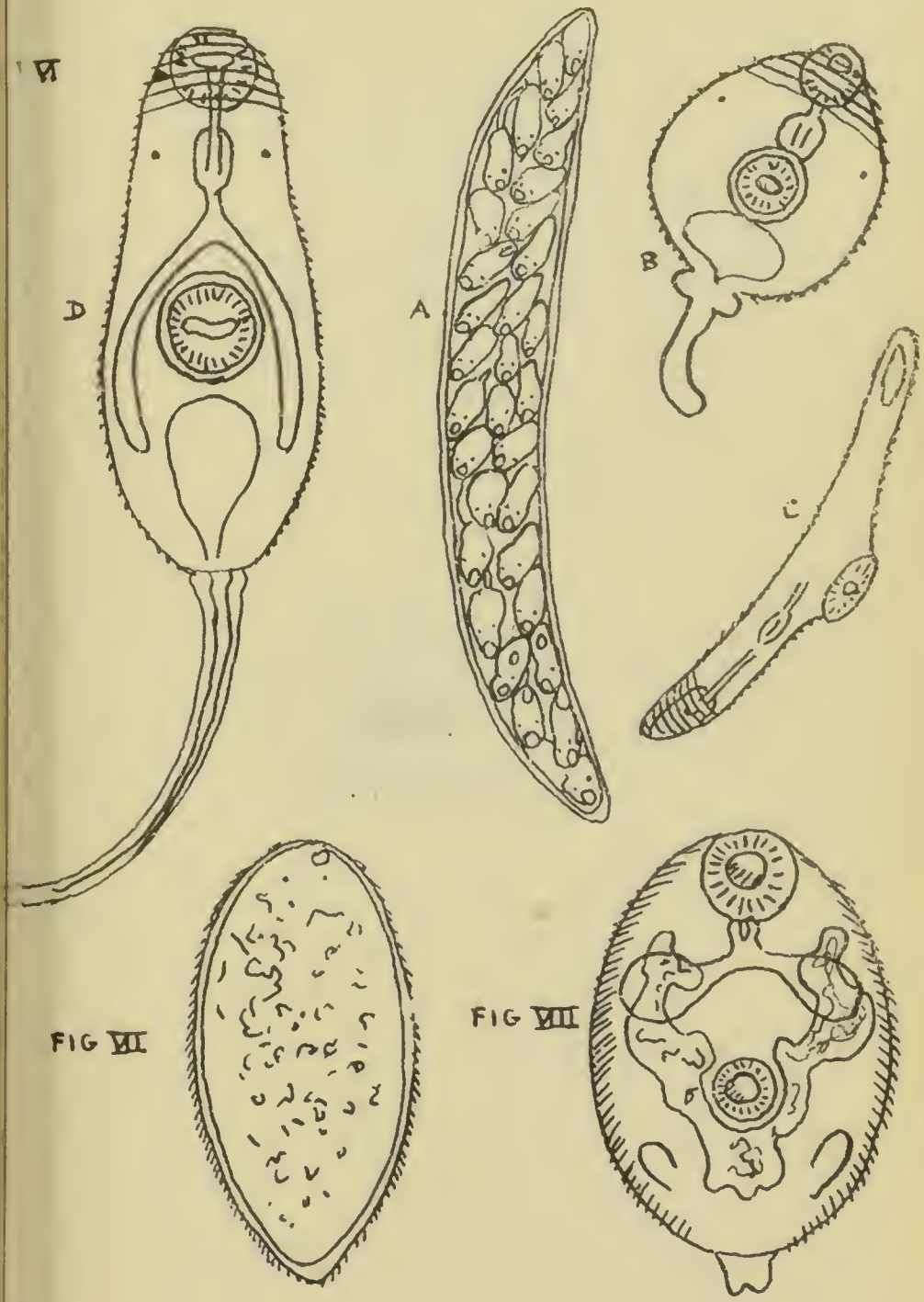


FIG VII

FIG VIII

PLATE III

INDEX TO PLATES.

E I. Fig. I.—Redia and cercaria from liver of *Littorina littorea*.
A. Redia full of cercariæ.
B. Young redia
C. Young cercaria.
D. Full grown cercaria.

Fig. II.—Encysted cercaria from liver of mussel.
A. Cercaria in the cyst.
B. Cercaria pressed out of cyst.

E II. Fig. III.—Sporocysts from liver of cockle.

Fig. IV.—Sporocyst and *Cercaria linearis* from kidney of *Littorina littorea*.
A. Sporocyst with cercariæ.
B. Cercaria.
C. Cercaria in different position.

Fig. V.—Sporocysts and cercaria from liver of *Littorina rudis*.
A. Sporocysts with cercariæ.
B. Cercariæ in natural positions.
C. Cercaria unfolded.

E III. Fig. VI.—Sporocyst and cercariæ from liver of *Buccinum undatum*.
A. Sporocyst with cercariæ.
B., C. and D. Cercariæ in different positions.

Fig. VII. Sporocyst from *Macoma balthica*.

Fig. VIII.—Cercaria from *Tellina tenuis* and *Donax vittatus*.

NOTE ON SALT-WATER POND AT AMBLE.

By A. MEEK.

The pond lies near to the south pier of Warkworth Harbour, Amble. The following facts with regard to it were related to Fishery Officer Taylor by the Amble fishermen.

About seven or eight years ago, they observed herring rising in the pond, and a herring net used by them was found to have meshed 15 herrings, which were thin, and had the appearance of spent herrings. Some two years later, using half a piece of line (30 hooks) they caught 15 dabs and flounders, and a few eels which they said were about 2½ feet long.

I visited the pond with Fishery Officer Taylor on 16th November, and arranged that a half length of line should be shot early the same morning. The latter when pulled in was found to have caught a flounder, a dab, and an eel. A slight quantity of material was obtained by the use of a bottom net and a small otter trawl by which a flounder and a dab were captured. The material yielded Macromysis flexuosa, Pleurobrachia, and minute Crustacea, which I handed to Professor Brady.

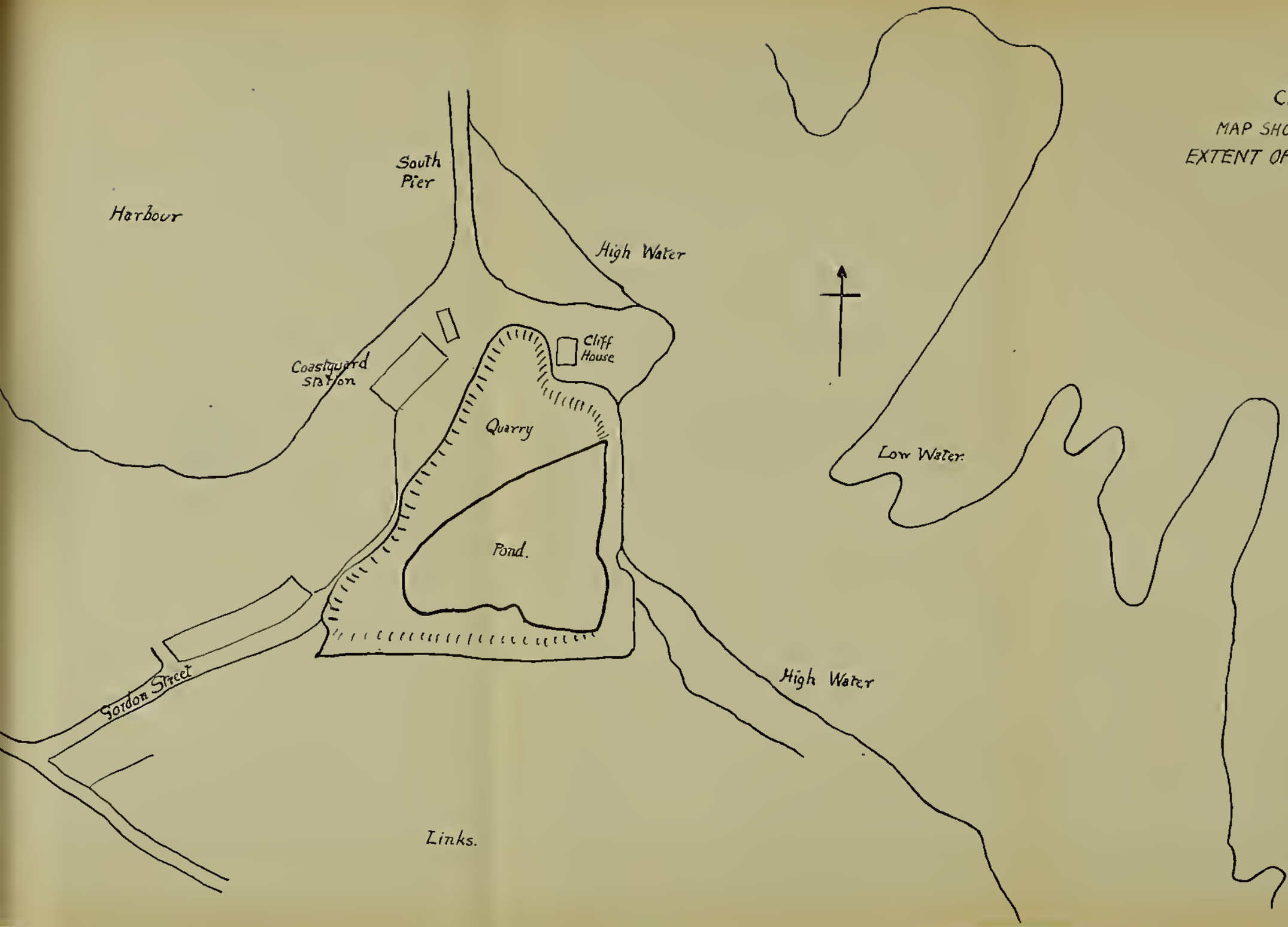
Small as the material was in quantity, it proved to be interesting for it contained, amongst other rare forms, an ostracod, which Dr. Brady says is almost if not quite morphologically identical with a fresh water species, but instead of being parthenogenetic like the latter it is bisexual. Dr. Brady has written a paper on the material he has examined from the pond and it will be published in the Transactions of the Natural History Society of Newcastle.

The pond was made, as the present owner Mr. R. G. M'Innes has informed me, by the quarrying of the stone required for the building of the piers at Amble, and for other purposes. When the Harbour Commissioners ceased working the quarry about 50 years ago, pumping was discontinued, and salt water from the sea entered. A pipe which was run through the wall allows of the water passing out and in.

The rise and fall of the water in the pond is very slight however. The area is 1¾ acres, but it could easily be enlarged on the landward side. The bottom slopes from an extreme depth of about 30 feet at the South East corner to the shore on the South West side and consists evidently of sand, mud, and stones.

CHART 6

MAP SHOWING POSITION AND EXTENT OF POND AT AMBLE.



. sample of the water was examined by Mr. Henry Renney of hemical Department (and for this being done I have to thank ssor Bedson) who reported as follows :—

Sample of water received, 1.11.05.

I have examined the above sample and find :—

(1) The specific gravity at 60 F = 1·02433.

(2) The total solids amount to 3408 grains per gallon (or 4868·5 per 100,000).

(3) The amount of chlorine is 1275 grains per gallon (or 1821·4 parts per 100,000)."

he pond, therefore, is very interesting with regard to the life it ins and has contained from time to time. A heavy sea at tides and especially at spring high tides washes over the wall t; and this is sufficient to explain the occurrence of the fish entioned.

is a place, however, which seems eminently fitted to put to test problems connected with the hatching and breed- the lobster, and other forms. It could easily be provided sluice-gate, could be completely enclosed, and there is room natever buildings and additional small ponds should be deter- l upon.